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PUBLISHED TWICE MONTHLY

PLAYMETER

JUNE 1, 1985

1985 SPRING BUYERS' GUIDE

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Twice a Month Publication for the Coin Operated Entertainment Industry

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Cover: Why, you might ask, is a unicorn featured on the cover of Play Meter's "Spring Buyers' Guide"? The answer, of course, is "Why not?"

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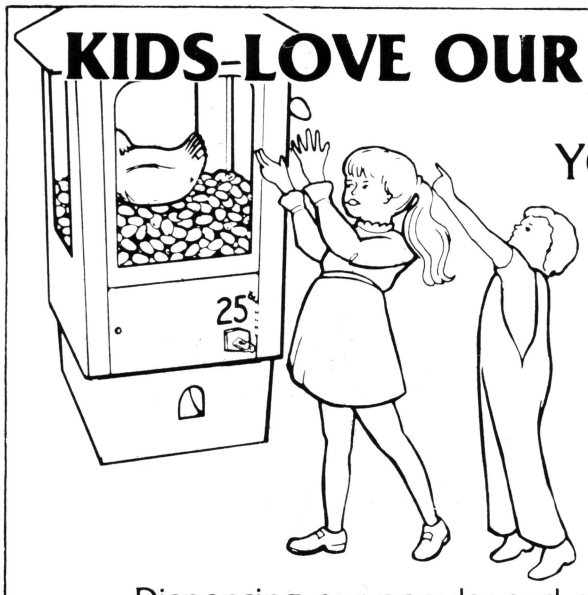

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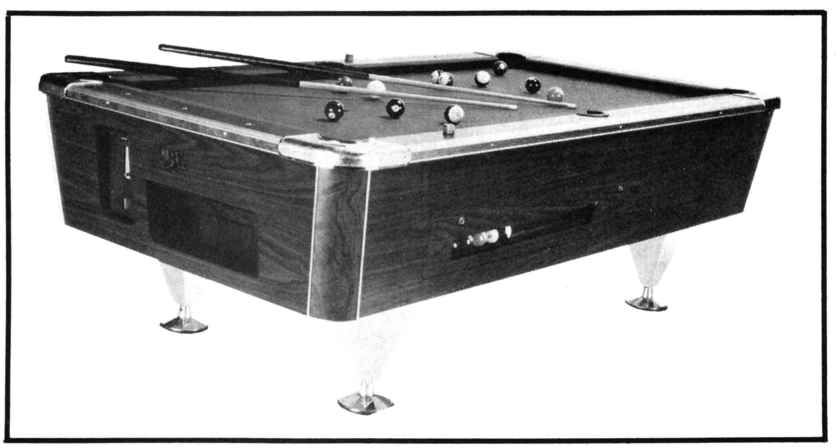

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A NEW EQUIPMENT POLL FORMAT

With this issue, we have changed the industry's regular equipment poll, "National Play Meter," to give our operator/subscribers better information when making decisions about their new equipment purchases. In the past, games in this industry were ranked according to their different classifications—that is, separate categories for pinballs, dedicated videos, conversion kits, laser disc games, and novelty devices. But this created the problem of leaving operators with the impossible task of comparing apples to oranges since such polls did not reflect how the top games in one classification stacked up against the top games in another classification.

Therefore, the new "National Play Meter" will rank the top 50 games, regardless of their equipment classification. The games' equipment classification is noted only on a checklist next to each entry; so operators can see what types of games are earning at the top of each poll.

We have also changed our polling method. In the past, *Play Meter* polled the same group of subscribers over and over again. This approach, however, is not as representative of the industry as a whole as the new approach we are now instituting. Over the course of the next several months, every operator/subscriber of *Play Meter* will be asked to fill out an equipment evaluation survey and return it to *Play Meter* for ranking purposes. Twice each month a different scientifically selected survey group will be mailed the survey.

The average operator/subscriber will probably be asked to respond to, at most, four such regular surveys over the course of the year (actually, it will probably be closer to two). In this way, we believe the new "National Play Meter" will be more reflective of the entire coin-operated amusement industry and not just a select number of operators who just so happen to respond to all the surveys. Such a polling procedure may create some significant fluctuations from poll to poll; but the findings will more accurately represent the whole coin-op equipment field.

Now, for what has not changed in the "National Play Meter." The ratings are still based on the only concrete way to evaluate games—what they generate in the cashbox. A survey which has operators rate game earnings as "excellent," "very good," "good," "fair," "poor," and so on, is unreliable because it multiplies a subjective factor by the number of people responding to the poll. After all, what is excellent for one operator may be merely good for another. So *Play Meter* will continue to ask operators to rate the games according to their actual cashbox collections. *Play Meter* then will translate this average into an index which allows a relative ranking of all equipment. As each survey is compiled, we plan on extending each game's index rating so you can tell trends about which games are fading and which are still holding their own after weeks on location. In this way, operators will be better served by the new "National Play Meter" and in a better position to make educated decisions about new equipment.

Finally, we thank you for your continued support of *Play Meter* and ask for your assistance whenever you are sent a *Play Meter* equipment survey form. For only with your input can we make the magazine as useful a tool as you want it to be.

David Pierson
Editor

NEWS BRIEFS

AMOA signs agreement

The board of directors of AMOA approved an agreement in principal April 17 with the performing rights societies concerning the compulsory jukebox licensing fee. The agreement became official May 13 in a Washington D.C. ceremony.

Robert W. Kastenmeier, chairman of the House Judiciary Subcommittee, presided over the meeting. The agreement entitles jukebox owners a $10 rebate for 1985 and 1986, and in 1987 if the 1987 fee specified by regulations exceeds $60 and at least 110,000 jukeboxes are registered.

An administration committee made up of three performing rights societies members and three from AMOA will be formed with the responsibilities regarding rebates, transfers, and new jukebox certificates.

In the next issue, the complete details on this historic compromise.

— — ● — —

AAMA elects new officers

The American Amusement Machine Association (AAMA) elected new officers at its annual meeting in San Francisco May 17.

Bob Lloyd of Data East was named the new president, replacing Joe Robbins who had been the president since AAMA's inception in 1981. Paul Moriarity of Taito was elected vice president and Norm Goldstein of Monroe, secretary/treasurer. Newly elected board members, joining Robbins, Lloyd, and Ron Judy of Nintendo are John Britz of Bally, Hideyuki Nakajima of Atari, Ira Bettelman of C.A. Robinson, Joe Dillon of Williams, as well as officers Goldstein and Moriarity.

Glenn Braswell, executive director of AAMA, in commenting on Lloyd's election, said, "I feel Bob will have some new thoughts and ideas to help the association. He should bring changes in direction and participation."

According to Braswell, AAMA currently has 24 manufacturer members, 17 distributor members, and four associate members. And though outgoing president Joe Robbins admitted to numerous complaints about low attendance at the March ASI show, Braswell insists the ASI show will be held March 7, 1986, at the convention center in Chicago.

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AMOA adopts new system for electing officers

At its annual mid-year board meeting held the middle of April, the Amusement and Music Operators Association (AMOA) modified its system of electing officers.

Previously, new officers were elected and installed at the AMOA Expo Board of Directors meeting during the AMOA convention held in late October or early November. Though the next president was usually the first vice president having worked his way through the ranks of AMOA, that person has been passed over in favor of another candidate on two occasions. So, the certainty of who would be president was never concrete.

With the new system, officers will be elected at the mid-year meeting, though they will not assume their designated offices until the AMOA show, giving them six months to prepare for their duties.

According to Leo Droste, executive director of AMOA, "This new system will enable the new president-elect to work closely with the current president to make the transition much easier."

Added Al Marsh, president-elect, "This system should work much better than the old. Since I am the first president elected under the new system, I feel it will give me a much greater opportunity to take over the office of president. I will work closely with John (Estridge, AMOA president) so there will be minimum time spent making the final transition."

The new president-elect is Marsh, Hart Novelty Company in Billingham, Washington. Other officers include first vice president-elect, Richard Hawkins, D & R Novelty, Rochester, Minnesota; Secretary-elect, Walter Bohrer, Jr., Hastings Distributing, Milwaukee, Wisconsin; and treasurer-elect, Clyde Knupp, Amuse-O-Matic, Fort Dodge, Iowa.

ATE will make no changes

The ATE show, to be held January 13-16, 1986, at the Grand Hall at Olympia, will follow the previous format of a four-day show including a preview day.

The show's organizers sent a questionnaire to 131 United Kingdom exhibitors to consider opinions on whether the show should continue its special preview day with the duration of four days or go with a three-day show.

Of 46 replies, the majority were in favor of the preview day but divided between a three- or four-day show.

The board felt that even though there seemed to be a desire for change, the number of responses did not represent all exhibitors. The board concluded that, had more wanted changes they would have taken advantage of the chance to express their desires. This, the board felt, could only mean that the overwhelming majority were satisfied with present arrangements.

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Destron settles

Donald P. Desmond, chairman of Destron Inc., Chicago based manufacturer of coin-operated vending and amusement machines, announced that a settlement has been concluded to eliminate its debt with Continental Illinois National Bank. Destron has been operating under Chapter 11 of the bankruptcy code since June 1983.

This settlement was made possible by an investment group, headed by Jack C. Hand, retired partner of Touche, Ross & Company, a Big Eight international public accounting firm; and Donald P. Carter, former chairman and chief executive officer of Cunningham-Walsh, an advertising agency.

The settlement represents the first step towards Destron's reorganization. A formal plan will be submitted to the court shortly. Terms of the settlement will be discussed therein.

According to the company, this will clear the way for Destron to obtain working capital during the reorganization plan review period and facilitate the forthcoming discharge from Chapter 11.

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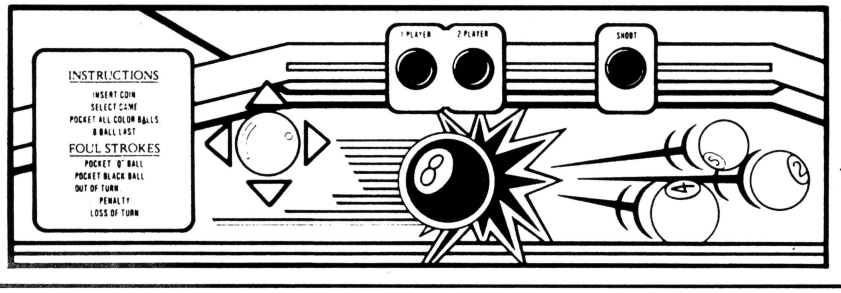

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Operators are buying again... but very smartly

By Valerie Cognevich

Operators, finally strong enough to buy new equipment again, are depending on other operators—more than distributor recommendations and manufacturer test reports—when making their buying decisions. And, although most concur the manufacturers are producing their best equipment in two years and that their hit ratio has improved dramatically, manufacturers are still feeling the pinch that will be magnified by the natural summer slowdown.

Operators are not investing in equipment like they once did, but they are buying more than they had for the past two years.

According to operator Jim Mason of High Country Games in Laramie, Wyoming, "I'm buying more than I did last year because the equipment is the best its been for two years. In fact, I hadn't bought anything in the last two years."

Echoing Mason, Paul Spiegel of Active West in Los Angeles said, "There is a lot of excellent product because the manufacturers aren't introducing garbage like two years ago. They're being more selective about what they introduce. Before, the manufacturers, especially the large ones, were coming out with games, not because they were good but to keep up with production. They simply forgot that supply does not mean demand."

According to Eric Jacobson of Amusement Devices in Kaukauna, Wisconsin, "Yes, I'm buying more than I did last year, but I'm watching very closely and being selective. I am upgrading my dart and trivia games."

Although the market has changed in the last few years, it's very similar to the way things were before the video boom. Said Spiegel, "We're back to being an honest industry. We're back to the 1980 level." That means back to phonographs and pool tables as the staples of an operator's route; and pinball, too, is enjoying a resurgence.

Play Meter's 1984 "State of the Industry" survey of operators revealed the industry staples were earning as they had through video's boom years. Now, however, with the video bust, those steady pool, phonograph, and pin collections are looking much better to operators. And that's reflected in the manufacturers' scramble to suit the operators' changing buying patterns.

Pinball companies, which had neglected pinball during the video boom, are introducing new lines of pinballs. Even the staid jukebox has undergone a transformation with video jukeboxes replacing older models. And pool tables and table soccer manufacturers are reporting increases in sales as the table games are regaining a higher place on routes. Electronic darts, though available for years, are the center of renewed interest because of promotion techniques.

According to Bob Dumas of Action Amusement in Corpus Christi, Texas, "Videos are a thing of the past. I am starting dart leagues and plan on starting pool table leagues. These league programs are what will save us."

As for video, certain patterns emerged—trivia games, systems, and sports themes all prevailed. Operators, trying to cut costs by converting old games into something new, were buying heavily into conversions. And dedicated games were almost completely neglected. The video bust had a sobering effect on operators.

Said Dumas, "If everyone would go with systems we would all do much better."

Mason put it this way, "I've tried the Nintendo system, and it's great. I haven't tried others, and, though I may be limiting myself, I would rather be the last kid on the block to have something than the first and chance getting burned. Nintendo made promises and kept them. They never said they were considering getting out of the business. Others made promises and didn't keep them."

The resistance to being the first on the block to have anything stands in stark contrast to how operators rushed to beat competitors onto the streets with hot, new games during the video boom.

Systems

As Mason's comments indicate, Nintendo led the way with the system concept. Only two other companies, Sega and Data East, had preceded Nintendo; but it was Nintendo which surprised the industry by turning out excellent, low cost kits for its VS. System. Since the introduction of the dual VS. System, Nintendo continues to improve without raising the price. Most recently, the company introduced the UNI System which is basically half of the dual VS. System. All games with the exception of *Tennis* and *Baseball* will adapt to the UNI

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System. New kits include *Duck Hunt, Excitebike, Hogan's Alley, Ice Climber, Pinball* and *Golf*.

Atari introduced two systems, each with an outstanding game. *Marble Madness* leads off System I and *Paperboy*, System II. Although the quality of the games is strong, price appears to have created some resistance to the Atari systems. And that again has reaffirmed the buyers stranglehold on the market—that operators, who once couldn't pass on a solid piece are willing to pass now if everything isn't just right.

Said Mason, "Operators can buy some of the new equipment at reasonable prices but some will have to lower prices." James Cates of Albany Amusement in Albany, Georgia, echoed Mason's comments, "Prices have been escalated for a long time. Price is one of my prime considerations when deciding on what to buy. The closeout prices of games taught us what they could really sell a game for."

Cinematronics' Cinemat System was introduced with *Cerberus* but the second offering, *Mayhem 2000*, has received encouraging reviews and may be the game that assures the success of the Cinemat system.

Konami premiered its Bubble System at the ASI show in early March but to date it has announced no plans for the release of games.

Bally Sente with its SAC-I System, has introduced *Chicken Shift, Goalie Ghost, Off the Wall, Hat Trick, Stocker*, and *Snacks n' Jaxson*. But the SAC-I premier game appears to be *Trivial Pursuit*, based on the board game. It's an attempt at mixing trivia games with the system format which operators are looking for, again showing a newfound consciousness on the part of factories to make what operators want.

This attempt to make new equipment purchasing as palatable and painless as possible is a big change from the video boom years when manufacturers dictated price, format, and availability to operators.

Conversions

Another example of the newfound interest in catering to the operator in this buyers' market is the amount of product manufacturers are introducing not even as systems but simply as conversion kits for older games. Actually, kits now account for the bulk of operator purchases. According to Tony Moore of State Amusement Company in Roanoke, Virginia, "Though I haven't really bought more dedicated games than I did last year, I have definitely bought more conversion kits. I have been converting a lot of my games to trivia because trivia games are hot right now."

Cates added, "The collections we have right now don't warrant buying anything but kits."

Jacobson of Amusement Devices in Kaukauna, Wisconsin, summed it up, "Manufacturers are finally making some good kits."

Manufacturers offered a variety of conversion kits. Atari offered *Empire Strikes Back* and *Return of the Jedi* conversions for *Star Wars*. Bally introduced *Flicky* and *S.W.A.T* for its Six Pac series, and *Galaga 3* as a conversion for any video game.

Exidy offered a graphically superior conversion for *Crossbow* called *Cheyenne*.

Kitkorp introduced its hit *Crown's Golf* as a kit. A St. Louis operator epitomized operators' reluctance to purchase even the best games if everything isn't just right when he noted at a distributor showing last year that *Crown's Golf* was the best game out, but he wouldn't buy it since it wasn't a conversion. And Kitkorp showed the willingness of manufacturers to give operators what they want by introducing the *Crown's Golf* kit.

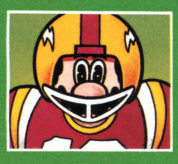
Konami introduced several kits including *Road Fighter, Super Basketball*, and *Yie Ar Kung Fu*, the latter two being popular sports themes.

Other companies offering kits include Magic Electronics with *Bullseye Darts, Samurai*, and *8-Ball Action*, all based on popular themes; Cardinal Amusements, (which was overwhelmed at the response it received at the AOE show on kits *Street Heat, Drakton*, and *Beastie Feastie*); Crown Vending, with *Hero in the Castle of Doom*; Memetron, a newcomer in the kit field with *Atomic Boy, Attack of the Savage Bees*, and *10-Yard Fight '85*; Monroe, with an update for its *Birdie King*; Nichibutsu, with *Magmax* and *Roller Jammer*; Progessive Game Distributors, with *Complex X* and *Trivia Master*;

How to go from golf

to tennis

to baseball



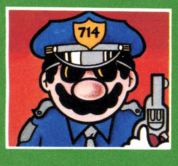
to football

to soccer

to ice-climbing

to motorcycle racing

to duck-hunting



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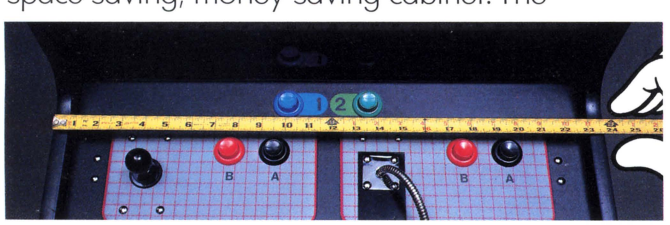

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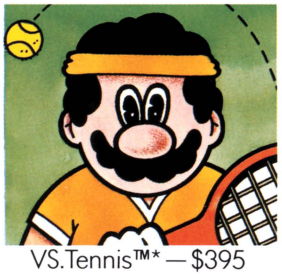

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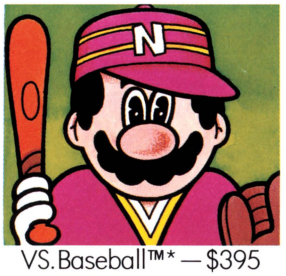

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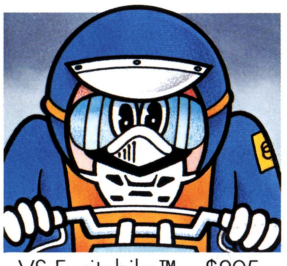

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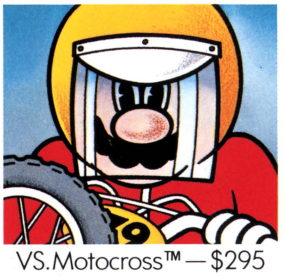
VS. Hogan's Alley™** — $295

VS. Duck Hunt™** — $295

VS. Nintendo 500™ — $295 (Summer '85)



VS. Motocross™ — $295 (Summer '85)

VS. Raid on Bungling Bay*** — $295 (Summer '85)

VS. Soccer™ — $295 (Summer '85)

VS. Helifighter™ — $295 (Summer '85)

VS. Football™ — $295 (Fall '85)

More great games to come!

Nintendo®

Suggested operator prices.

*Interactive game—uses both screens (VS. DualSystem only).

**Requires gun attachment at additional cost.

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Romstar (formerly SNK), with *Son Son, Great Swordsman, Kickstart*, and *Mad Crasher*; Sunn International, with *Lizard Wizard*; Universal, with *Do! Run Run, Top Gear* and *Indoor Soccer*; and Williams, with *Aeroboto* and *1942*.

Dedicated

Ironically, Data East, which was the first company to introduce the system concept, is offering only dedicated games. And though operators are purchasing more conversions some see the need for good dedicated pieces; and Data East, on the strength of *Karate Champ* and *Kung Fu Master*, are generally first in line when operators talk about buying dedicated games. Moore of State Amusement put it this way, "Though I'm buying more kits for my established locations, I'm buying a few dedicated games for new locations. Some operators have just given up so there are new locations. We're going after them with a positive attitude."

And Spiegel of Active West in Los Angeles noted, "I find I am buying more of one good game instead of three or four of different ones like I did in the past." Data East's two games, *Kung Fu Master* and *Karate Champ* have consistently topped the National Play Meter since their introduction and indications are that its latest game, *Commando*, will be as good. If Data East contines to buck the trend, offering dedicated games when others are succeeding only with systems and conversions, then this Santa Clara, California, company will continue its singular approach to the coin-op amusement market. When Data East first introduced its Deco Cassette System, saying it was the only hope for an industry gone amuck, distributors and other manufacturers said conversions in any form would not work. Now that nearly the entire industry has converted, Data East has flip-flopped back to dedicated games...and again has landed on its feet.

Tehkan, who has primarily licensed games to other manufacturers, introduced *All American Football*. Reminiscent of Atari *Football*, the game has exceptional graphics and should be a natural during the coming football season.

Other outstanding dedicated games include Bally's *Demolition Derby*, and Sega's *GP World*, a laser disc driving game.

Trivia

Gray area and former gray area game manufacturers led the push to trivia games. And realizing increased collections with these games, they pushed still others into the mad scramble. First in was Status Games with *Trivia Quiz I*, which they followed with *II*, and *III*. Merit then offered its *Trivia Whiz* as a conversion for *Pit Boss* and has updated it with *Trivia Whiz II*. Greyhound came out with *Video Trivia* and *Sexual Trivia*. SMS introduced *Trivia Hang-Up*, and Electro Sport *Trivia Chase*. M. Kramer has just released *La Trivia*, and Progressive Game Distributors, not a former poker game manufacturer, introduced *Trivia Master* at the AOE show.

Pins

The pinball resurgence was evident with the undisputed hit of the AMOA, *Space Shuttle*, a Williams pinball. And though operators are still reluctant about buying new pins, many are testing the viability of pinballs by putting out used ones. Said Jim Mason, "I have bought a few pins and they are doing very well. *Space Shuttle* is fantastic and I'm getting ready to call and order a *Chicago Cubs "Triple Play."*

Jacobson said, "Pinballs are stagnant, but you never know what will happen. There are some good pins being introduced."

Premier introduced *Chicago Cubs "Triple Play"* at the AOE show, and it was an instant success. This company, that embodies the soul of its predecessor D. Gottlieb & Co., will be focusing its energies entirely on pinball and novelty pieces, according to company spokesmen.

Other new pinballs include Bally's *Fireball Classic* and *Cybernaut*, Game Plan's *Lady Sharpshooter*, Williams' *Sorcerer* and conversion for *Pennant Fever, Gridiron*, Wico's *Af-Tor*, and Zaccaria's *Devil Riders* and *Magic Castle*.

Other equipment

Operators are looking to other types of equipment to top off the

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balance of games in locations. This includes the electronic darts which are becoming more popular. Jacobson noted, "I have some dart games still on location after eight years. Operators who want to be successful with their dart games must push leagues."

ICE, which introduced the novelty game *Chexx*, has a soccer version called *Kixx*. Meltec, known for *Boomball*, launched its new shuffle target game, *Target Ace*. Pop-A-Shot offers as basketball throwing game with the same name.

There have been several reflex games and blood pressure/heart rate machines introduced. Players can test their punching strength on Mematron's *Punch Power*. Movie Hut has two sticker vendors, *Vend-A-Sticker* and *Tobi*, the robot sticker vendor.

Operators choice

Operators have a vast array of equipment to choose from. In making their buying decisions, they are depending more on other operators. Some still listen to distributors' recommendations and gut instinct.

Said Mason, "I talk to other operators and only those distributors who also operate to see what is doing well for them. I don't pay much attention to polls anymore because what is hot in one area may not be hot in another. I previously just called the distributor and had him send me whatever was new or whatever I had heard was good. Not anymore though. I'm waiting a lot longer to see how a game does."

Now that nearly the entire industry has converted, Data East has flip-flopped back to dedicated games... and again has landed on its feet.

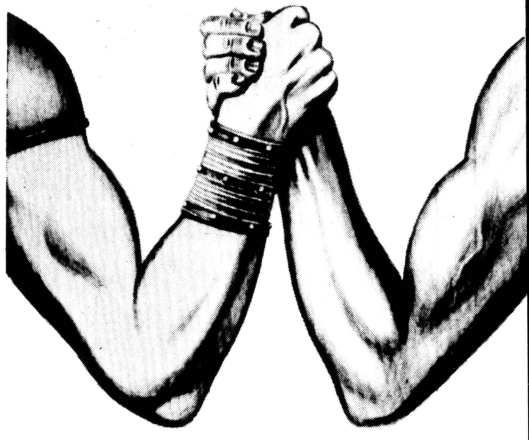
Jacobson agreed, "I look at what games are doing for other operators, then I make my decision." Cates said, "I listen to what the distributor says but I make my decision after talking with operators who already have the game."

Moore still depends on his distributor. "My distributor field tests the games and I trust their input. I really depend a lot on Jim Frye (Brady Distributing). I only buy from top manufacturers because of back up service." Dumas said that he mainly makes his decisions by the seat of his pants. "I listen to distributors. They usually have a good knowledge of what the games will do but I still have to have a gut feeling about it."

Spiegel bases his buying decisions on what was previewed at the trade shows and talks with distributors. "When I know something good will be coming out, I budget my money for that game instead of buying what is out at the time."

Though operators are in a better position to invest in new equipment, they do so cautiously, waiting to make sure the game is not one to rise to the top and drop as fast. Manufacturers are being cautious too in what they offer operators.

This prudent attitude may be what is necessary for the industry to once again establish the delicate balance of supply and demand. •



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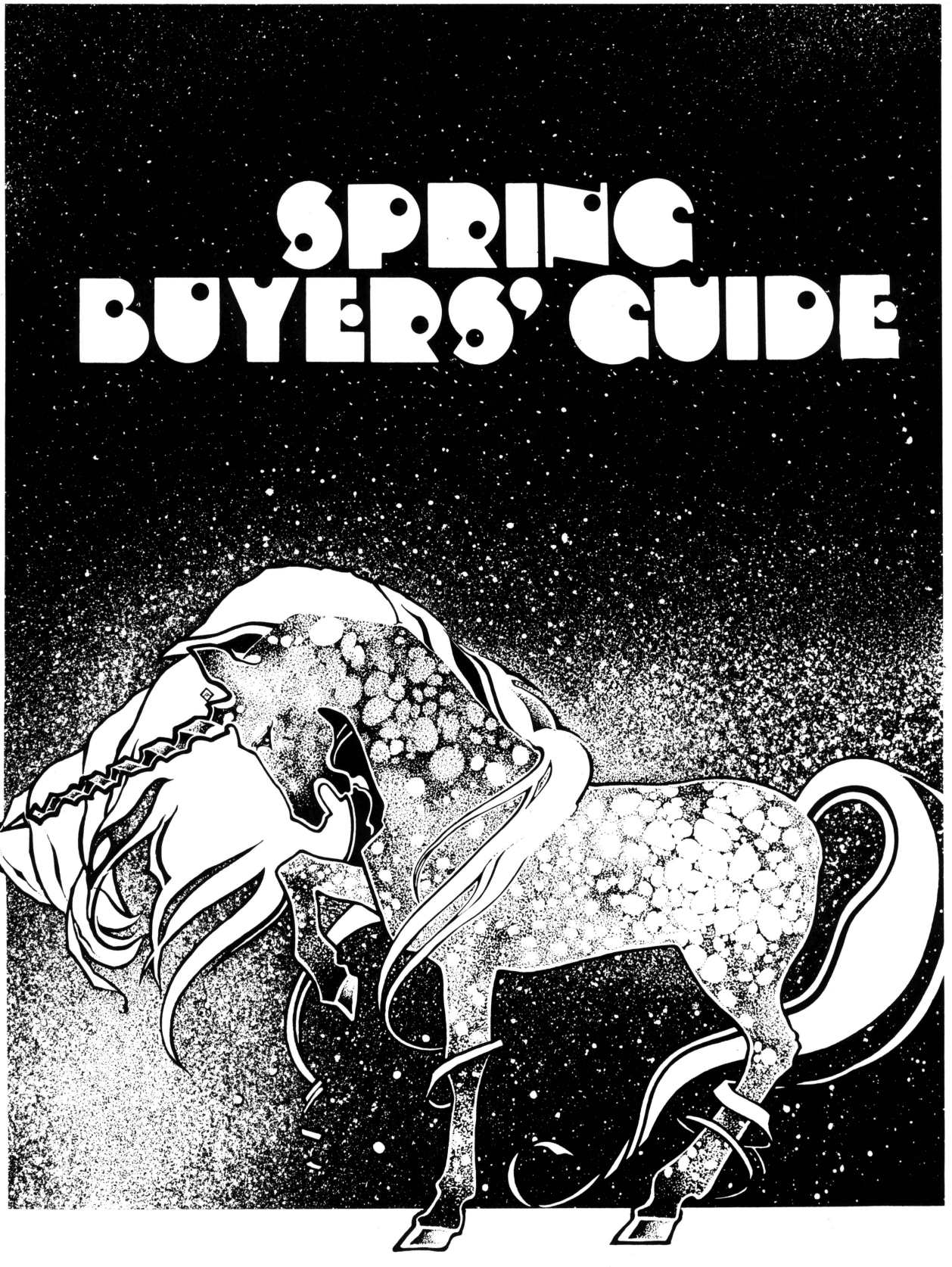
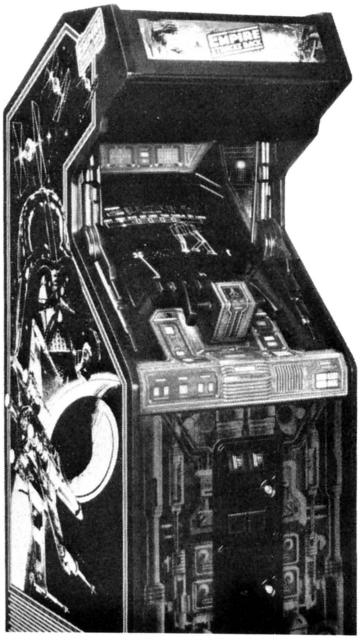


VIDEOS

AMUSEMENT TECHNOLOGY

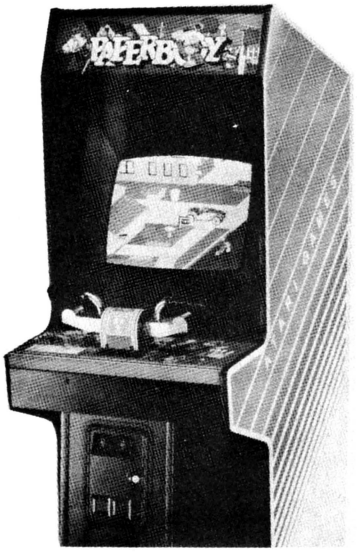
Max Experience
Flight simulator designed to accept PC board-generated flying or driving video games.



ATARI

Empire Strikes Back
Conversion for *Star Wars* in upright or cockpit. Game play features sequences of music, sound, and voice effects from the movie.

Marble Madness
First software for System I Conversion System.



Paperboy
First software for System II Conversion System.

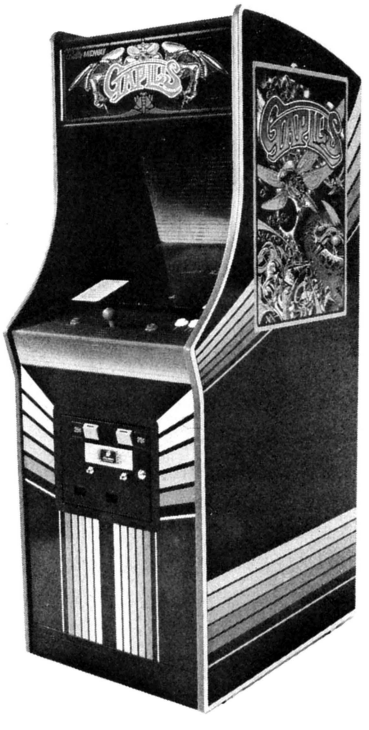
Return of the Jedi
Final game in *Star Wars* triology.

BALLY

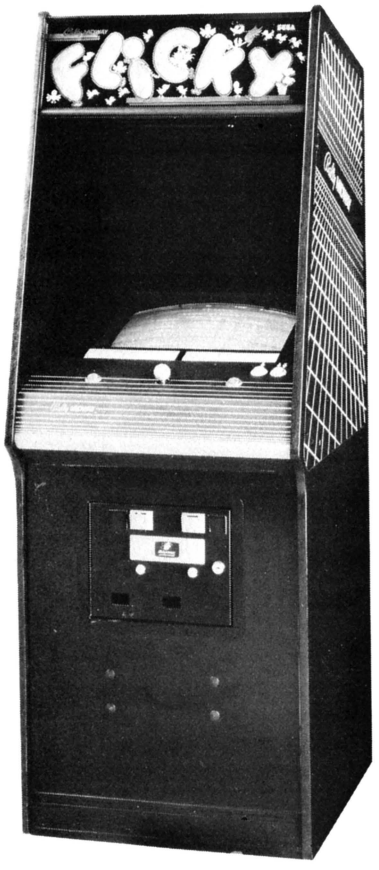
Bank Panic
Licensed from Sega. Player is a bank teller shooting outlaws entering through 12 doors. Object is to only shoot the bad guys, not citizens. Sold exclusively through Video Ware.

Demolition Derby
One to four players control steering wheels with object to survive the demolition derby.

Galaga 3
Conversion for any video game. Adventure of a lethal outer space battle. Uses 8-way joysticks.



Gaplus
Introduced as dedicated game. The player must defend the earth from killer insects.

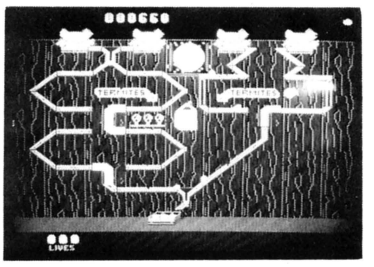


Flicky
Part of Six-Pac series. Flicky, the bird, must rescue baby chicks from alley cats. Offered as dedicated or kit.

Pac-Land
This Pac-Man adventure has Pac-man taking a journey in search of fairyland. Offered as a dedicated game.

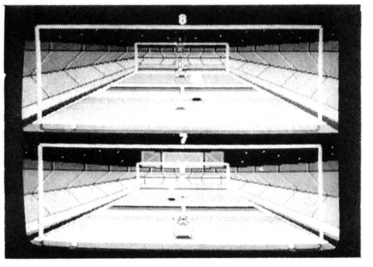
S.W.A.T.
Software for the Six-Pac series. Offered as dedicated or kit. Player uses laser gun to ward off growth of pink modules. Severed pink ones become blue and become a potent bomb.

Timber
A dedicated game. Player controls a team of lumberjacks trying to tumble trees.

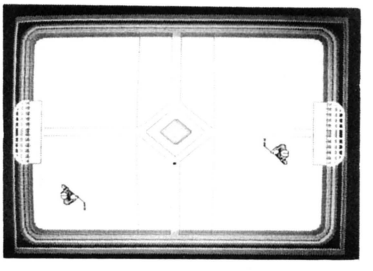


BALLY/SENTE

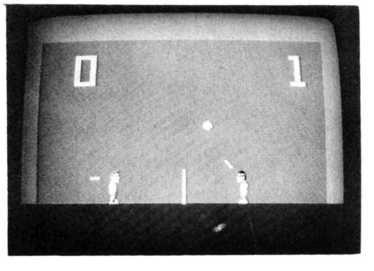
Chicken Shift
Software for SAC-I System. Player must guide eggs through a maze. Includes a select-a-level feature.



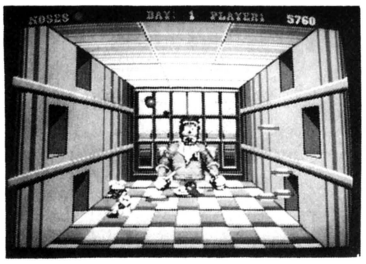
Goalie Ghost
Software for SAC-I System. Three-dimensional perspective sports game. Players attempt to kick a ball through an apponent's goal.



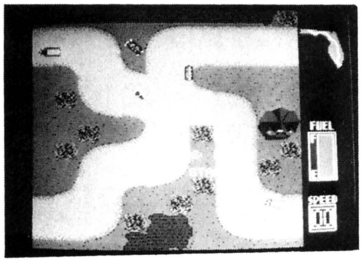
Hat Trick
Software for SAC-I System. One or two player hockey game. Player guides hockey player over the ice.



Off the Wall
Software for SAC-I System. One or two player sports theme combining elements of racquetball and tennis.



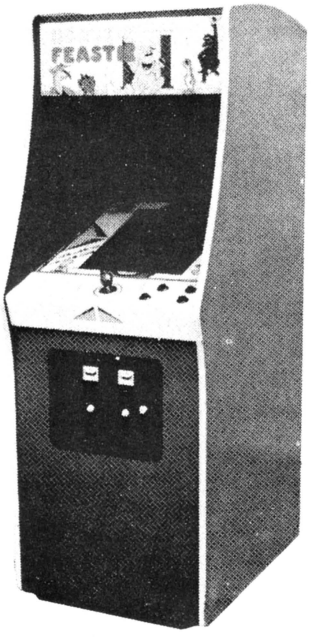
Snacks N' Jaxson
Software for SAC-I System. Player controls a clown who tries to eat his way through life without letting his nose break any windows. Has a select-a-level feature.



Stocker
Software for SAC-I System. Player drives a car over a cross country course against a field of apponents.

Strike Avenger
First game for the simulator SAC-II System. Player maneuvers his spaceship through a running battle with a pirate force.

Trivial Pursuit
Software for SAC-I System. Produced under license from the original board game. Can be played by one to four players.



CARDINAL AMUSEMENTS

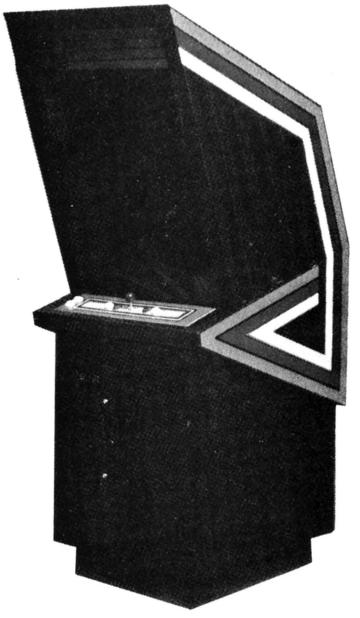
Beastie Feastie
Conversion for *Pac-man* or vertical raster scan games. Player guides Toby, who is constantly hungry through different levels of play.

Drakton
Conversion for any vertical raster scan video. Player guides a Drakton fighter through eight galaxies as he battles enemies.

Street Heat
Conversion for *Donkey Kong* and *Donkey Kong, Jr.* A racing game with a variety of cars and scenery.

CENTURI

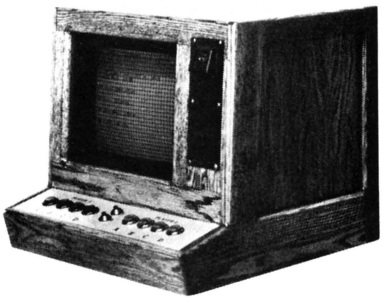
Mikie
Sold through Video Ware as a kit. Mikie player helps deliver a love letter to his girlfriend.



CINEMATRONICS

Cerberus
First game in Cinemat System. Either one or two player. Two players can compete simultaneously. Player collects fuel for the space station.

Freeze
Available as dedicated or conversion. Player must descend into underground caverns on an ice planet to capture a Mondo-Crystal.



Infomania/Reflex
Solid oak countertop with optional base. Two games in one. One tests eye/hand coordination and the other is a trivia game.

Mayhem 2000
Roller derby theme. Throwing a ball into competitor's net is object to score. Cinemat System.

Scion
Universal kit for horizontal raster scan monitors. Player travels through a matrix of 999 difficulty levels.

CROWN VENDING

Hero in the Castle of Doom
Conversion for *Donkey Kong* and *Donkey Kong, Jr.* Player travels through a variety of mazes on a search and rescue treasure hunt.

DATA EAST

Commando
Licensed from Capcom. Dedicated only. A war theme where player crosses enemy lines fighting enemies.

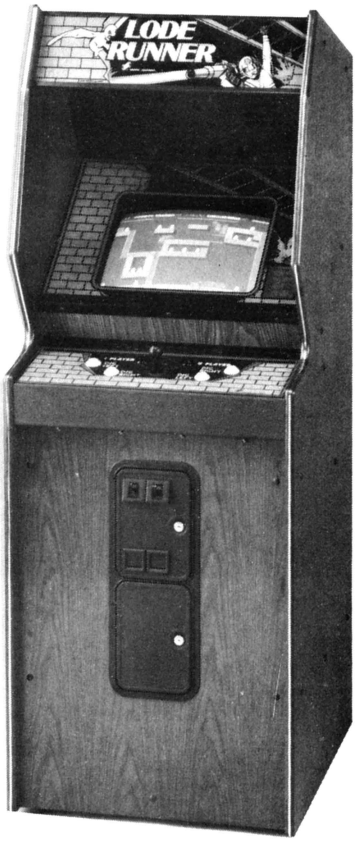
Karate Champ
A dedicated game. Player advances from training stage to more difficult matches of karate.

Kung Fu Master
Offered as dedicated game. Player must use his Kung Fu techniques to battle enemies as he attempts to rescue his girlfriend who has been kidnapped.

DIGITAL CONTROLS

Crowns Golf
Licensed as a countertop. Three-dimensional scenes of the layout of each hole make it a close-to-the-real-thing golf game.

Little Casino III
Little Casino made for the countercade system. Contains five games in one.



Lode Runner
The company's first dedicated upright. A previous home computer release. Player tries to retrieve treasures stolen from the Bungelling people.

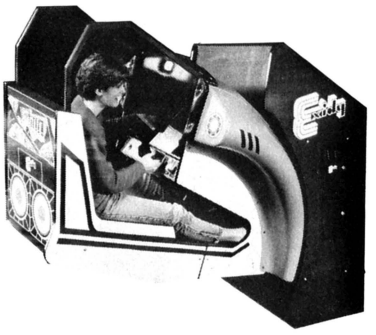
Tactician
Countertop game. Player pushes buttons 1-20 to match a randomly selected number on the machine.

ELECTRO-SPORT

Trivia Chase
Four categories with time limit per question. Thousands of questions in new categories. Advertising message display.

EXIDY

Cheyenne
A conversion for *Crossbow* but graphically superior. The player must protect Buster Badshot against enemies in his quest for gold. Has an unbreakable aluminum gun stock



Vertigo
Vertigo is first game in the XCD-1 Environmental System. The player is on a special mission from earth where he must rid space of alien terrorists.

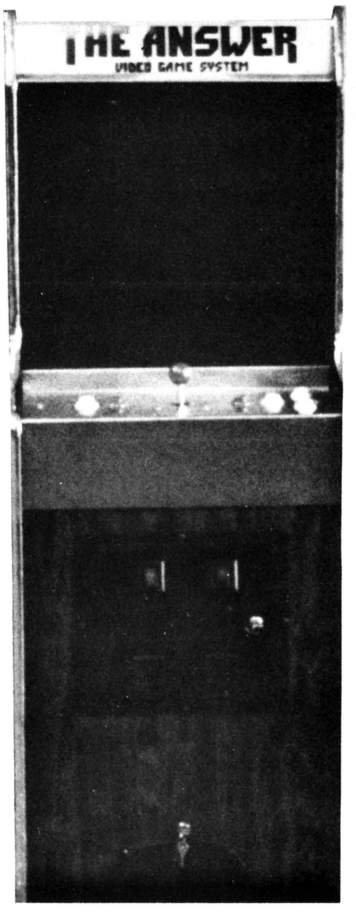
FUNAI

Esh
Laser disc conversion. Player travels through more than 20 scenes to rescue a princess from the evil emperor Esh.

Zangus
Laser disc conversion. Space battle game where a boy becomes a space traveler looking for the planet Zangus.

GAME EXCHANGE

Hot Seat
Flight simulator designed for easy retrofit to any driving or flying video game.



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GREYHOUND

Video Trivia
A trivia game allowing player to choose from a variety of categories. Player can wager points for maximum scoring.

PUB TIME

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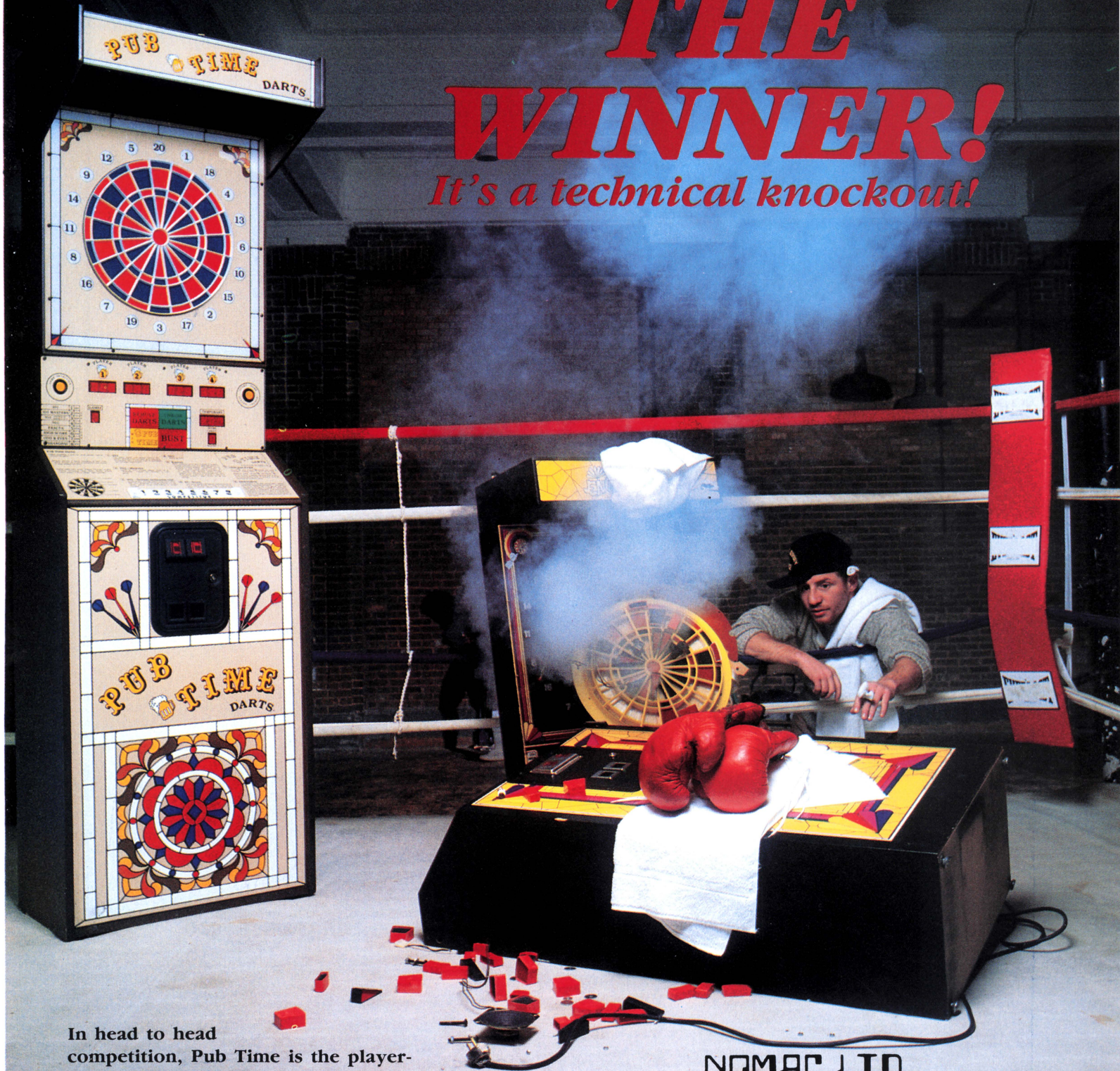

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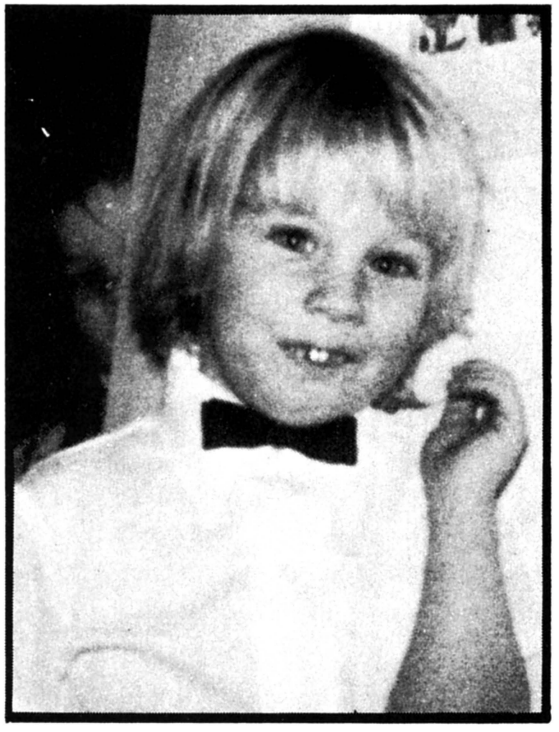

James Karl Watts

Age: 6 years
D.O.B.: March 13, 1978
Hair: Blond
Eyes: Blue
Height: average
Weight: average

Distinguishing marks: front 2 teeth with silver caps.

Disappeared May 9, 1982 from Allentown, Pennsylvania

Jessica Laura Watts

Age: 9 years
D.O.B.: November 22, 1975
Hair: Light Brown
Eyes: Brown
Height: average
Weight: petite - has husky voice

Disappeared May 9, 1982 from Allentown, Pennsylvania

If you have information about either of these children please call: 1-800-235-3535

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Crowns Golf
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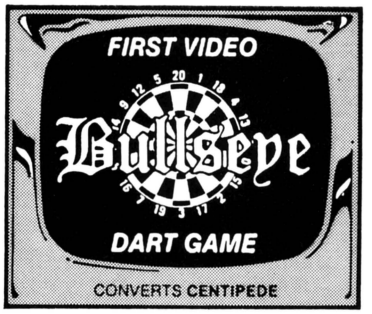
KONAMI

Road Fighter
Conversion for vertical raster scan games. Players competing in a road-rally must race around the track for best time.

Super Basketball
Conversion for vertical raster scan games. This basketball themed game has all the sound effects of a real game, crowds, the ball being dribbled down the court, and referee calls.

Yie Ar Kung Fu
Conversion for horizontal raster scan games. Cutesy characters use the latest Kung Fu maneuvers to fight it out.

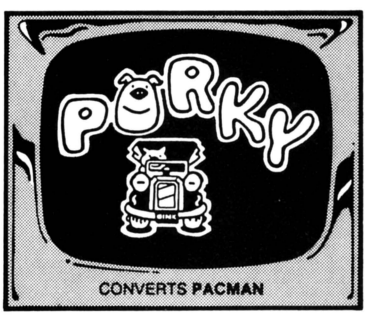


MAGIC ELECTRONICS

Bullseye Darts
Conversion designed for *Centipede*. Three dart games available in this first video dart game.

Driving Force
Designed as conversion for *Galaxian* and *Pac-Man*. Exciting driving game.

8-Ball Action
A pool table game designed to convert *Donkey Kong* and *Donkey Kong, Jr.*



Porky
Designed as conversion for *Pac-Man*. Porky is a pink pig driving around in a buggy dodging obstacles.

Samurai
For any vertical monitor. Samurai warrior wards off enemies using a sword.

MEMETRON

Atomic Boy
Licensed from Irem. A computer has gone berzerk in an orbiting space station due to a meltdown. Player's objective is to shut down computer to save the earth.

Attack of the Savage Bees from Saturn
Licensed as a kit from Capcom. Player fights off the attacks of killer bees.

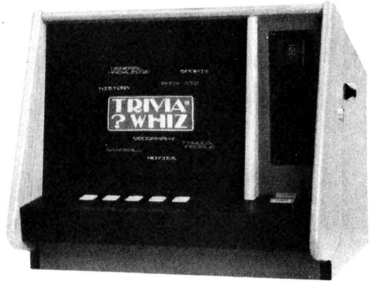
10-Yard Fight '85
For horizontal monitors. Football theme trying to score touchdowns.

MONROE/COIN-IT

Birdie King 3
Conversion for *Birdie King 2*. A newer, more challenging golf course highlights this follow-up to the popular *Birdie King* game.

Buggy Challenge
Licensed from Taito. This driving game has the player driving across an open field (not a track) avoiding obstacles.

Star Force
Licensed from Tehkan. The space patroller is out to destroy enemy fighters in volleys of force beam.



MERIT

Trivia Whiz
One- or two-player countertop trivia game. Easy to read, large question base, amusing effects and humerous answers, and speed bonuses.

Trivia Whiz II
Complete new 10,000 question module with up to four-player capability and more than 30 topics. New explanation feature gives further interesting information on selected questions.

NICHIBUTSU

Magmax
Conversoin kit. Player controls a Maxcraft whose pilot is the last hope to free a civilization from the grip of an evil empire.

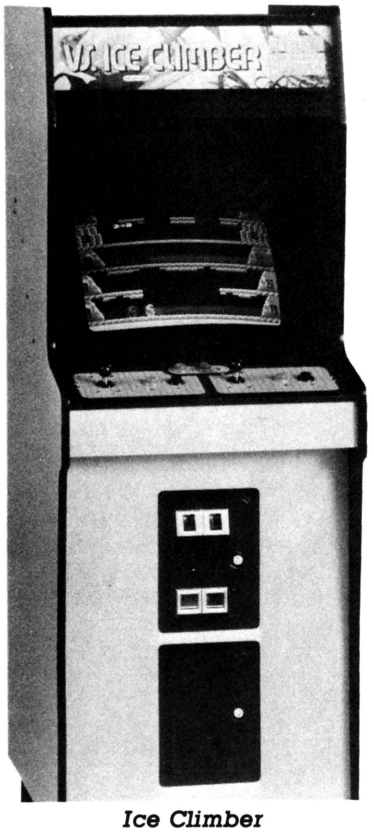
Roller Jammer
Dedicated game. *Roller Derby* theme where player goes from novice to professional trying to beat competitors.

NINTENDO

Duck Hunt
Player tries his luck and skill at duck hunting in this kit for the UNI System or half of the VS. System.

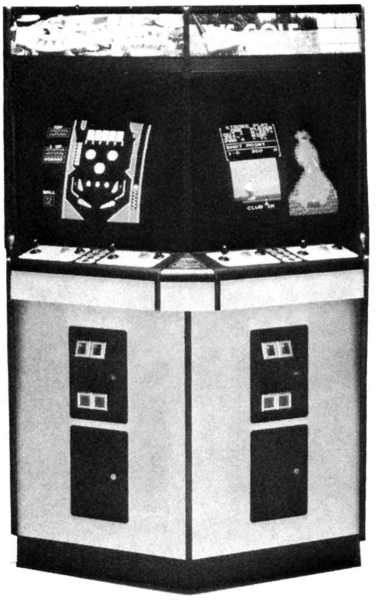
Excitebike
Motocross action game. Players must complete a qualifying round then go on to compete. Players go over jumps, and around oil slicks on regular or turbo power but must not overheat.

Hogan's Alley
Game features a pistol in a holster in this cops and robbers themed game for UNI System or half of the VS. System.



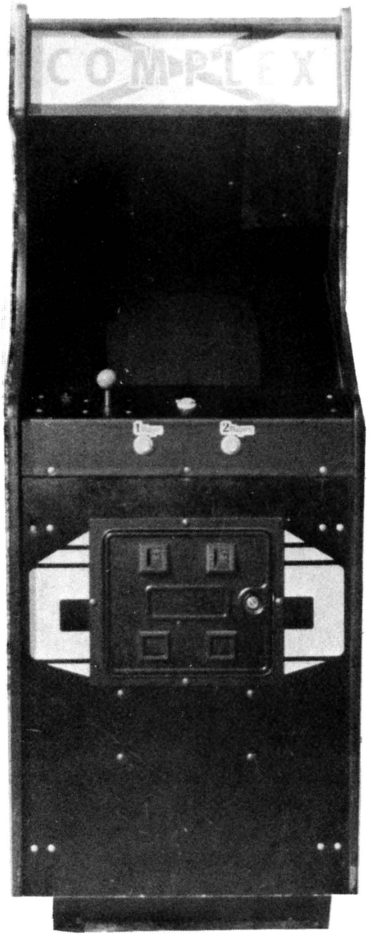
Ice Climber
With ice ax in hand, players try to conquer one of 24 randomly generated mountain peaks either alone or with another player in pursuit of the summit. For UNI System or half of VS. System.

Super Punch-Out!!
Dedicated or conversion for *Punch-Out!!* Player takes on up-and-coming champions. Only a knockout before the clock runs out keeps player in ring for the next contender.



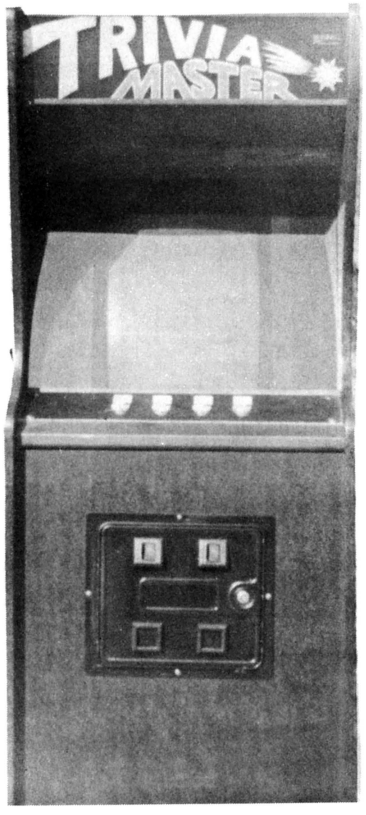
VS. Golf
Offered with *Pinball* for dual VS. System or separate for UNI System. Players compete against the course or challenge each other in stroke or match play.

VS. Pinball
Offered as duel kit for VS. System with *Golf* and separate for UNI System. One or two players. Push button controls for flippers with extra balls for high score. A bonus screen for extra points.



PROGRESSIVE GAME DISTRIBUTORS (PGD)

Complex X
Dedicated PCB kit or E-Prom kit for *Qix, Zookeeper, Space Dungeon,* or *Electric Yo-Yo.* Ernie must escape from a nuclear reactor while being pursued by nuclear bugs as the reactor is filling with radioative soup.



Trivia Master
One to four player trivia PCB kit to fit any color game. Over 3,000 questions in four categories.

RDI

Thayers Quest
Laser conversion for *Dragon's Lair* or *Space Ace*. A young hero strives against ancient evil looking for a powerful talisman to restore lost majesty of a fallen kingdom.

SEGA

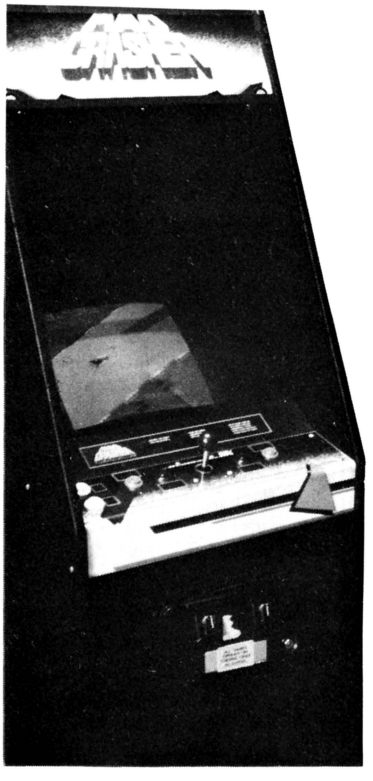
GP World
Dedicated laser driving game. Player participates in three Grand Prix races.

Pitfall II
Comic-theme game. Pitfall Harry is searching for lost treasure hidden in ancient caverns. Available as a dedicated game. First introduced as home computer software.

SNK/ROMSTAR

Great Swordsman
Conversion kit for horizontal monitors. A fencing game where player battles gladiators with kendo and fencing on various levels.

Kickstart
Conversion kit. Player drives motorcycle around various tracks against time and obstacles.



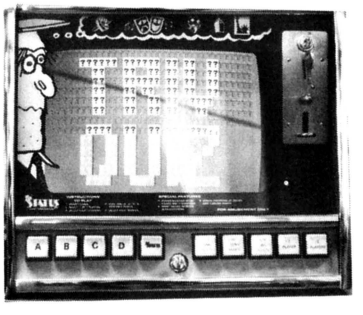
Mad Crasher
Conversion kit. Player propels himself into the far reaches of space on a futuristic cycle avoiding menacing enemy cycles.

Son Son
Conversion for horizontal monitors. One or two players travel through a maze shooting enemies and picking up treasure to get to the pot of gold.

Vulgus
Conversion for horizontal monitors. Player must destroy enemy insect mutants that infest the planet Vulgus.

SMS

Trivia Hang-Up
One or two player upright trivia game. Large storage capacity with thousands of new questions.



STATUS GAMES

Trivia Quiz
Upright or countertop. Trivia game with built-in advertising feature. Thousands of questions in various categories. Company has already introduced *Trivia Quiz II & III*.

SUNN INTERNATIONAL

Lizard Wizard
Conversion for *Pac-Man* and *Ms. Pac-Man*. Player must survive attacks by the mystical wizard and fire breathing lizards.

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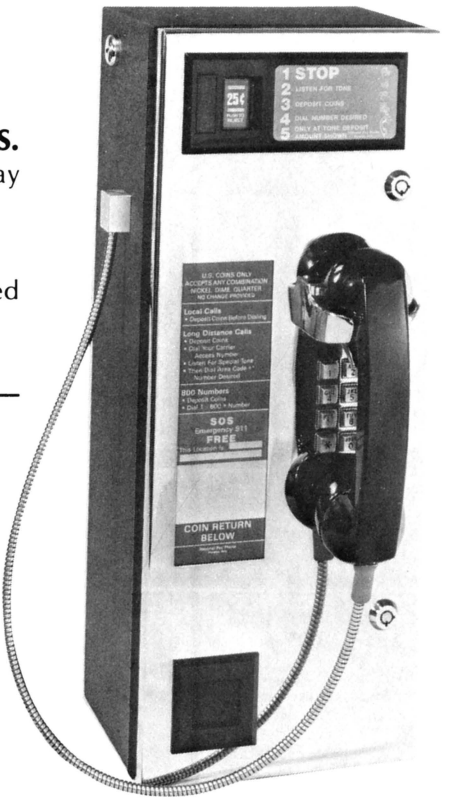

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TELEX: 295379 TABLEVISION

TEHKAN

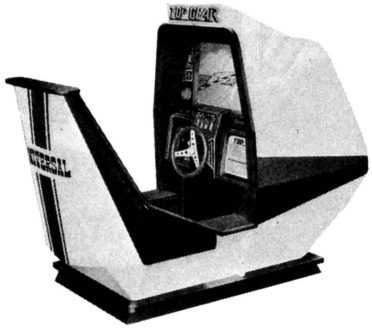
American Football
Reminiscent of Atari *Football*. Features trackball, exceptional graphics, and lots of action as players compete on the football field.

UNIVERSAL

Do! Run Run
Mr. Do! races from danger using flaming powerballs and rolling logs. Universal kit for horizontal raster monitors.

Indoor Soccer
Soccer theme. One to four players can compete at the same time.

Super Don Quix-ote
Laser conversion. Don Quix-ote is trying to reach a castle to reach his true love, Isabella. He must fight a demon and challenges on his journey.



Top Gear
Laser disc driving game. Available in cockpit style. Player travels four courses, present, near future, future, and space racing against time.

WICO

Regulus
Licensed from Sega. Conversion for horizontal raster scan monitors. Space theme where player shoots evil mechanical bugs trapped in a maze.

WILLIAMS

Aeroboto
Conversion for horizontal color raster monitor. Characters change form during play like the popular toys, transformers. Player travels across land, water, and outer space.

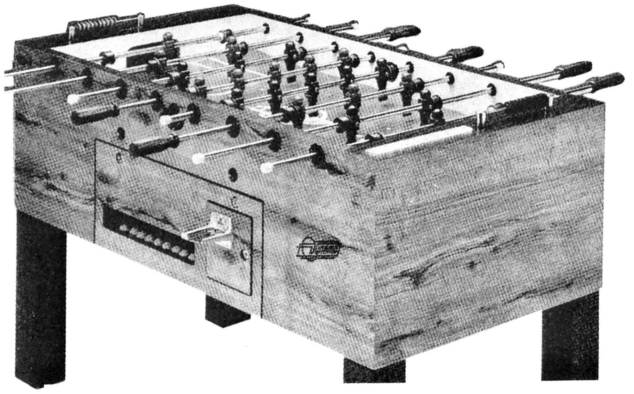
1942
Conversion kit. The player's P38 aircraft is pitted against Japanese Zeroes. He can pick up POW's for extra points. Has buy-in feature.

Turkey Shoot
A gobble blight has transformed a third of the earth's population into turkeys. The player is the turkey terminator. The game features an accurate attached gun.

ZACCARIA

Shooting Gallery
Player uses a rifle to shoot at various targets on the video screen. Exceptional clear graphics and maximum control on rifle.

TABLE GAMES



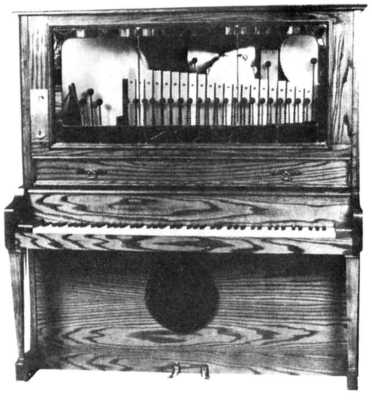
DYNAMO

DS-3 Soccer Table
Table soccer with improved features including one piece playfield.

VALLEY

Lynx
Newest in pool tables designed to complement the *Cheyenne Cougar*.

MUSIC



AMI

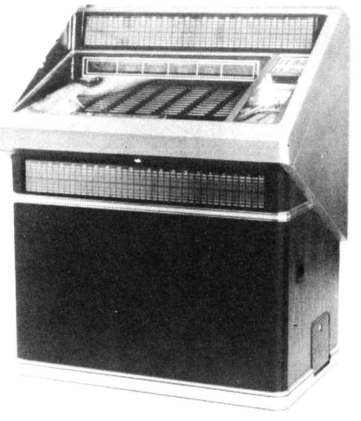
Entertainer II
Electronic version of the piano/orchestration can be played manually as a piano or automatically with coded instruction tapes.

ENTERTAINMENT VIDEO

Maxx II
Laser disc video jukebox. Holds eight laser discs and computer driven system. Computerized search gives rapid access to plays.

MEMETRON

Playmate Escort
Full view wall box. Perfect partner for any jukebox where you need more than one sight to drop money and play music.



ROWE

Golden 89
Two hundred selection phonograph features high tech styling, full range stereo sound, Rowe's dual channel 3-way speaker system, new selector keyboard, four separate digital displays, and newly designed central microcomputer. Will accept video.

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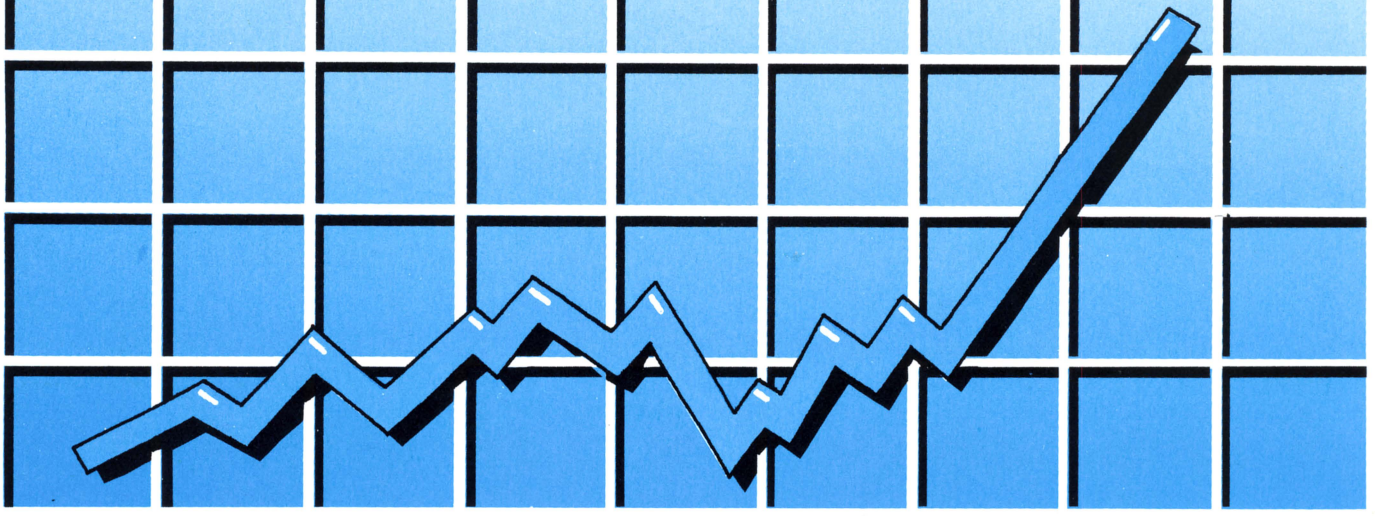
Poll Information

The following are rankings of the top games in the coin-operated amusement industry. The games are ranked according to an index formulated from a regular survey of operators of coin-operated amusement equipment. Games not appearing on this poll either (1) did not generate a five percent response or (2) did not rank among the top 50 games in the country. The games are further identified by their general equipment classification type: Video, Pinball, and Novelty. The average index rating for all surveyed games for this individual survey was 77.

Game/Manufacturer	June 1	Video	Pinball	Novelty
1. *Kung Fu Master*/Data East	188	•		
2. *Triva Whiz*/Merit	152	•		
3. *Marble Madness*/Atari	138	•		
4. *Yie Ar Kung Fu*/Konami	137	•		
5. *Video Trivia*/Greyhound	135	•		
6. *Karate Champ*/Data East	132	•		
7. *Space Shuttle*/Williams	130		•	
8. *Spy Hunter*/Bally Midway	128	•		
9. *VS. Excitebike*/Nintendo	117	•		
10. *Crossbow*/Exidy	115	•		
11. *Ice Fever*/Premier	114		•	
12. *Cheyenne*/Exidy	108	•		
13. *Jacks to Open*/Gottlieb	107		•	
14. *Road Fighter*/Konami	101	•		
15. *Shoot Away*/Namco	99			•
16. *Skee-Ball*/Skee-Ball	98			•
17. *Pole Position II*/Atari	93	•		
18. *Black Pyramid*/Bally Midway	92		•	
19. *Pennant Fever*/Williams	90		•	
20. *The Empire Strikes Back*/Atari	87	•		
21. *Two Tigers*/Bally Midway	87	•		
22. *Eight Ball Deluxe*/Bally Midway	87		•	
23. *Punch-Out!!*/Nintendo	86	•		
24. *Pole Position*/Atari	85	•		
25. *Fireball*/Bally Midway	85		•	
26. *Big Bat*/Bally Midway	85			•
27. *Firepower II*/Williams	83		•	
28. *Return of the Jedi*/Atari	76	•		
29. *Bomb Jack*/Tehkan	76	•		
30. *Super Punch-Out!!*/Nintendo	75	•		
31. *Strike Zone*/Williams	75			•
32. *Birdie King II*/Coin-It	73	•		
33. *Triv Quiz*/Status Games	72	•		
34. *Circus Charlie*/Konami	70	•		
35. *Alien Star*/Gottlieb	70		•	
36. *10-Yard Fight*/Taito	69	•		
37. *Kings of Steel*/Bally Midway	69		•	
38. *Super Basketball*/Konami	68	•		
39. *Spy Hunter*/Bally Midway	68		•	
40. *Laser Cue*/Williams	68		•	
41. *VS. Baseball*/Nintendo	67	•		
42. *Major Havoc*/Atari	66	•		
43. *Timber*/Bally Midway	63	•		
44. *Galaga 3*/Bally Midway	62	•		
45. *Hyper Sports*/Konami	62	•		
46. *Pub Time Darts*/Nomac	62			•
47. *VS. Tennis*/Nintendo	61	•		
48. *English Mark Darts*/Arachnid	61			•
49. *Millipede*/Atari	60	•		
50. *Tapper*/Bally Midway	60	•		

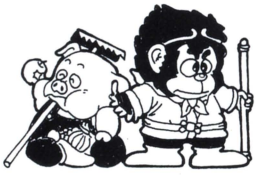
THE NEXT GENERATION IS HERE

ROMSTAR



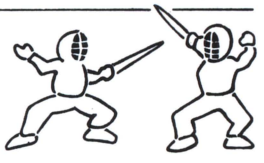
CONVERT TO PROFIT

ROMSTAR INTRODUCES THREE NEW CONVERSION KITS FOR THE PROFIT-MINDED OPERATOR



SON SON A two player cartoon game with great play action, music and graphics. Easy to play, hard to master. Broad player appeal for kids 6 to 60.

GREAT SWORDSMAN An action packed sports/fighting game with three venues of competition including fencing, kendo and Roman gladiator. Great income!



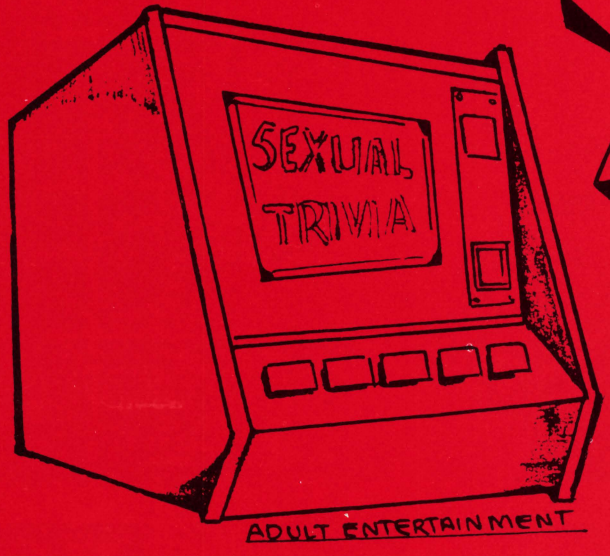
KICKSTART An exciting driving game which features motorcycle racing on a road course. This should appeal to the pole position fans. Kickstart has steady, long-term income.

For the name of your nearest Romstar Distributor contact John Rowe at:

ROMSTAR 3043 Kashiwa Street, Torrance, CA 90505 213/539-2744 Telex 182426

SEXUAL TRIVIA

KITS



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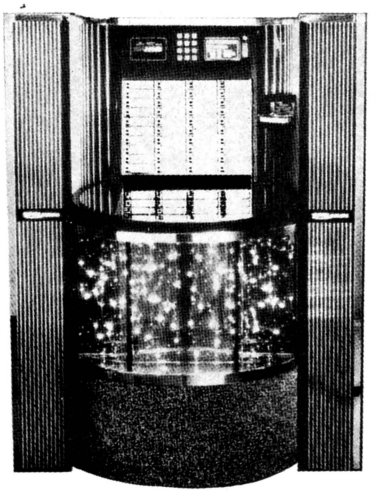
Sapphire 89
Two hundred selection with Rowe's dual channel three-way speaker, expanded digital display, redesigned central microcomputer, sleek new back-lit selector keyboard, and two eye catching bar graphs that pulsate in time to the music.

Video Music Entertainment Center
Beta hi-fi video jukebox. Includes two VCR's and central computer to control all functions. The system will allow multiple remote monitors.



SEEBURG

Prelude
Adaptable to compact discs. Classy combination of chrome and black with mirrored tile display and graphic patterns. First offering from this newly organized company.

WEAVER ENTERPRISES

VJ Video Disc Jukebox
Latest in video disc technoogy. Highest guality picture and sound. Available in three designs, Standard, Hi-Tech, and Hideaway. Includes three video disc players, two 50-watt speakers, and accepts remote monitors.

PINBALLS

BALLY

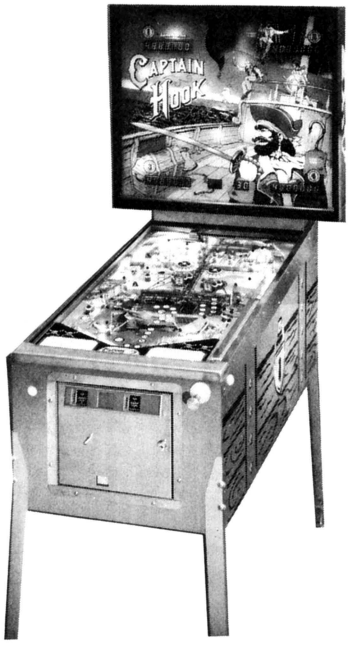
Cybernaut
Theme is based on an unusual half man/half robot creature. Features include futuristic graphics.

Fireball Classic
A remake of a previous electromechanical pinball. Features are included from previous game with added challenges.

Spy Hunter
Named after Bally's popular video game. Player stocks up on missiles, oil slicks, and smoke screens by driving ball through weapons warehouse. Features shooter lanes, target action, boob-balls, and target tactics.

GAME PLAN

Agents 777
Player joins the agents Elliot Nest, Melvin Narvous, J. Edgar Snooper with slot machine characters. Features a multitude of skill shots, dual top access, slot machine playfield awards, and extra flippers.

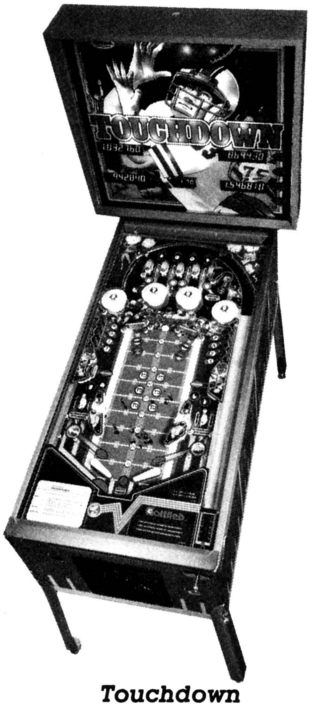


Captain Hook
Pirate ship themed game. Features include sabre-rattling sounds, spinner access to top, stationary and drop targets, and an extra flipper at top of playfield.

Lady Sharpshooter
Cocktail pinball with optional extender base for stand-up play. Features include fast action, skill shot, bonus multiplier, and spinner access to top.

MYLSTAR

Alien Star
Four player capability. Features playfield simplicity and classically pure shots. Completing spot target and rollovers earns extra balls, bonus multiplier, or accumulated bonus. Also features two-ball mode.



Touchdown
Four player capability. Players compete on an electric gridiron by scoring touchdowns and points. Two playfield spinning targets advance player's position toward opposing goal line via running plays while completing P-A-S-S spot target.

PREMIER TECHNOLOGY

Chicago Clubs "Triple Play"
Officially licensed from the Chicago National League Ball Club. An all American baseball theme With new alpha-numeric scoring display for players to enter intitials.

Ice Fever
A hockey-themed game where players knock down drop targets for a goal shot. Three goals advance the hat trick bonus multiplier. Spelling out Ice Fever drop targets earns a free game.

El Dorado-City of Gold
Player adventures into the ancient Mayan empire where graphics simulate a hidden temple filled with riches. A bonus is obtained by knocking down upper row of targers.

WICO

Af-Tor
Wico introduced this pin at the AMOA in October

WILLIAMS

Gridiron
Conversion for *Pennant Fever* or as dedicated game. Features cheerleader and crowd sounds. Offense begins at 20-yard line with four downs and four possessions. The defense can blitz, rush, or use nickel formation.

Sorcerer
Playfield embodies the soul of the Sorcerer's penetrating stare. Sorcerer speaks and taunts in a powerful voice. Features include a ramp for multi-ball, lane change feature, second chance post between the flippers, bonus hold-over, and extra ball.

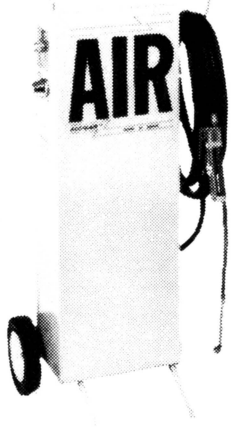
Space Shuttle
A replica of NASA's space shuffle enhance playfield. Features include two or three ball multi-ball carrying locked balls over from player to player, triggering a heat shield to prevent draining between flippers, activating an airlock to keep the ball in play. and chance to match a flashing backglass number for special.

ZACCARIA

Devil Riders
Features a double playfield, 3-dimensional animated backglass with a powerful voice. A motorcycle theme. Players hit drop targets to get to the upper playfield. While on upper playfield, the motorcycle on the backglass moves faster and faster as player scores.

Magic Castle
The 3-dimensional animated backglass features haunted house theme and sounds. A voice informs player that Dr. Zekyll, Zankenstein, or Zaccula is alive at which time player can shoot an upper ramp scoring bonus points.

OTHER EQUIPMENT

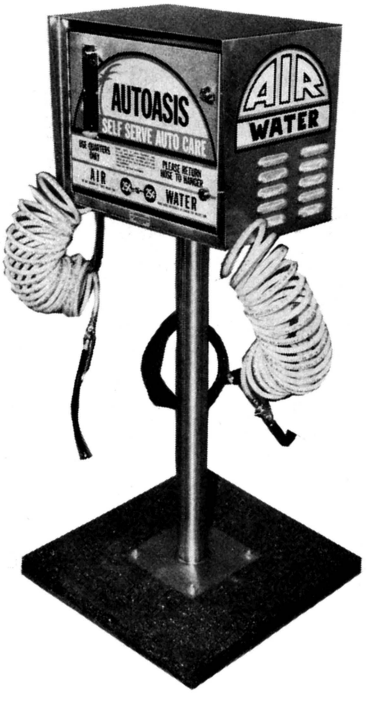


ALLIANCE INDUSTRIES

Acc-u-Air Tire Inflators
Special compressor design coin-op tire inflator.

AUTOROVO

Flying Eagle
Hydraulic kiddie ride.



AVS SYSTEMS

Autoasis
Coin-operated air or air/water vender.

BALLY

Big Bat
Electro-mechanical baseball game.

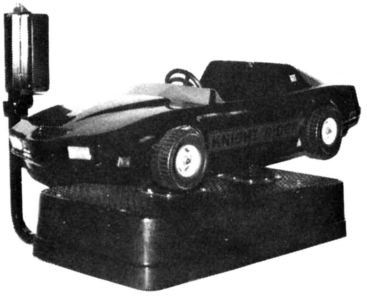
Strikes & Spares
Hi-tech improved puck bowler.

BETATEK

Speed Limit
Non-video raction game.

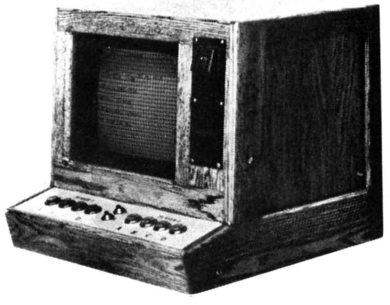
BETSON

Big Dipper
By Sega. One to four player merchandiser.



CAROUSEL

Knight Rider
Outdoor kiddie car ride.



CINEMATRONICS

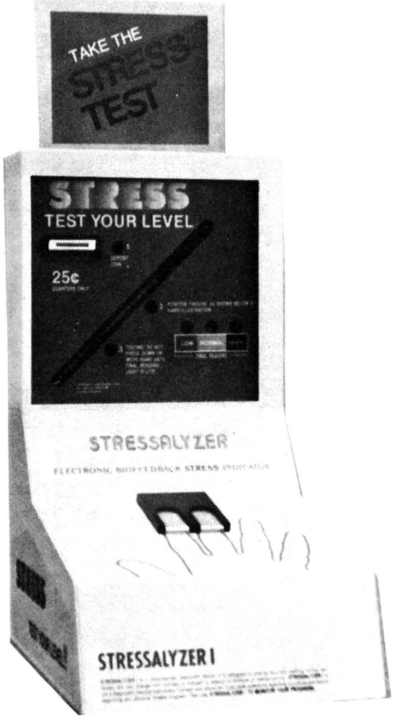
Info-Mania/Reflex
Countertop two games in one.

COIN CALL

PS 100 A
Private coin-operated pay phone.

COINTEL

Pay Telephone
Private coin-operated pay phone.

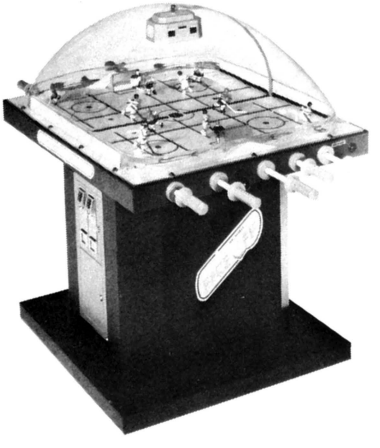


COMPUVEND

Stressalyzer
Electronic biofeedback stress indicator.

EMPIRE LIBERTY

703 Liberty Phone
Private coin-operated pay telephone.



ENTERTAINMENT ENTERPRISES

Face-Off
A re-engineered version of original.

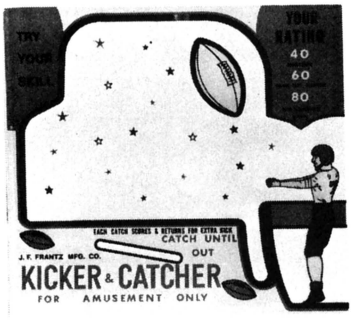
FELCO

Pay Phone
Private coin-operated pay phone.

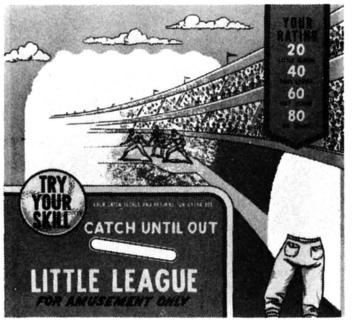
J.F. FRANTZ

Big Top Gumball Vendor
Play a game on this non-electric gumball machine.

Big Top Pinball
Countertop novelty mechanical pinball.



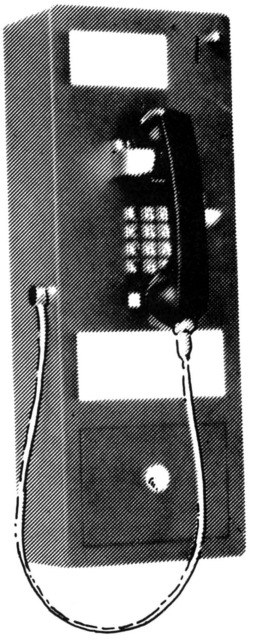
Kicker and Catcher
Countertop novelty mechanical game.



Little League
Countertop novelty mechanical game.

Long Shot
Countertop novelty mechanical game.

Pot of Gold
Countertop novelty mechanical game.



GLADWIN

Carefree Phone
Private coin-operated pay phone.

HI-COUNTRY MANUFACTURING

Memory Challenger
Test memory and coordination matching computer generated color sequences.

IMPERIAL INVESTMENTS

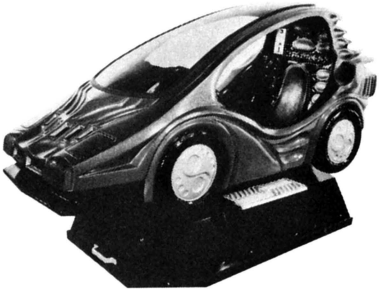
Speed Zone
Electronic reflex tester.

ICE

Kixx
Two to four player soccer game in style similar to *Chexx* hockey.

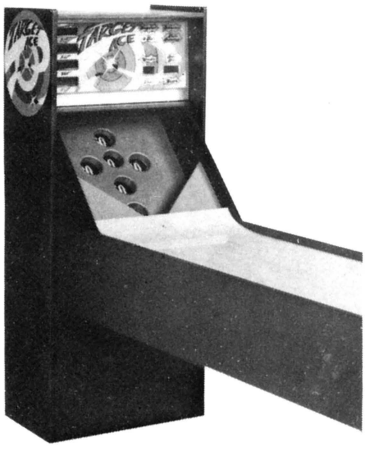
INTOXIGRAPH

Intoxigraph
Coin-operated breath alcohol analyzer.



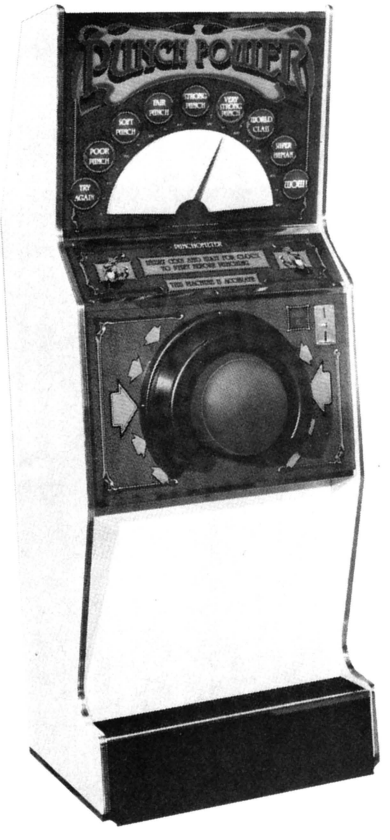
KIDDIE RIDES USA

Brooks Line of kiddie rides
Includes Alien Invaders, Alien Interceptor, Draakon Marauders, Star Chaser, and Super Car.



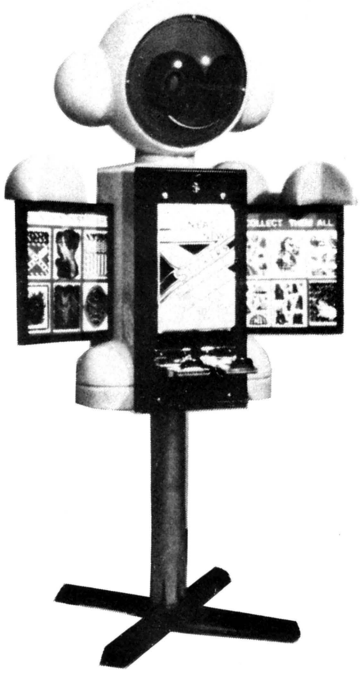
MELTEC

Target Ace
Up to four player shuffle target game.



MEMETRON

Punch Power
Player tests punching strength.



MOVIE HUT

Tobi
Sticker vending machine with robot-look.

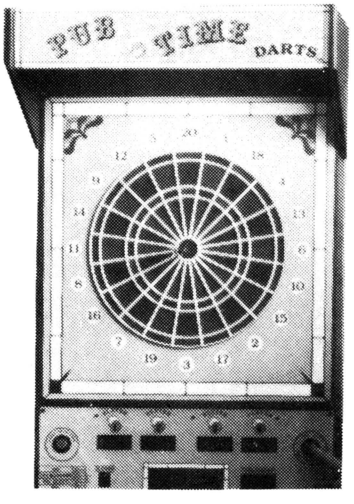
Vend-A-Sticker
Floor or countertop sticker vendor.

NATIONAL

Pay Phone
Private coin-operated pay phone.

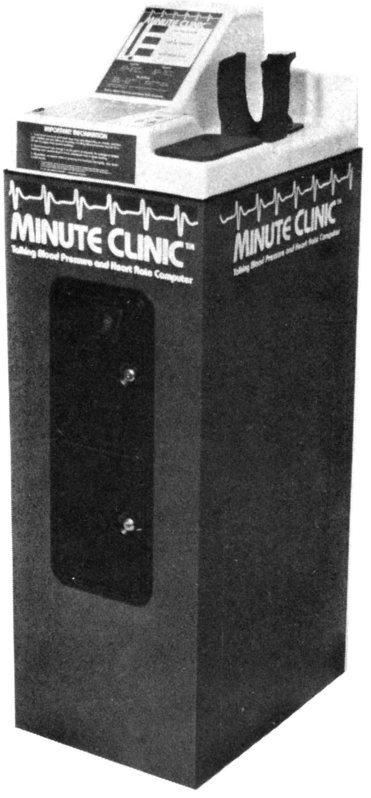
NEW TECHNOLOGY

AT-1, Hello Telly
Private coin-operated pay phone.



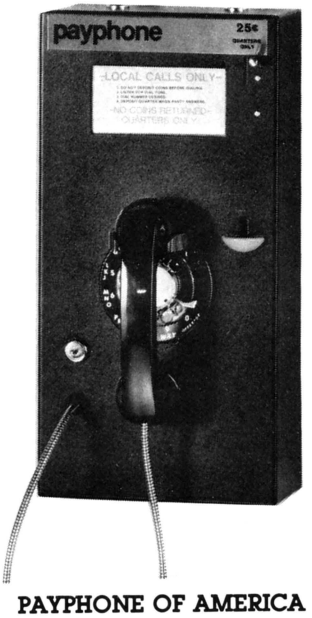
NOMAC

Pub Time Darts
Coin-operated electronic darts.



PATENT DEVELOPMENT & MARKETING CORP.

Minute Clinic
Computerized blood pressure/ heart rate machine coin-op or free use.



PAYPHONE OF AMERICA

H 100 P
Private coin-operated pay phone.

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Games that never stop earning.

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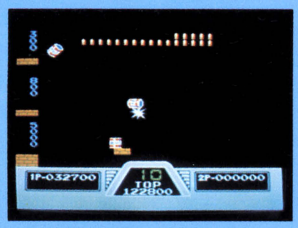
Take Aim At VS. HOGAN'S ALLEY

Nintendo tests your sharpshooting skills at the FBI's training camp in this exciting new game for the VS. SYSTEM.

With the light gun attachment in hand, you've got to respond with split second accuracy and instinct to protect innocent lives and bring down the bad guys. Do you have what it takes to be an agent? Take on VS. HOGAN'S ALLEY and find out.

A fast eye and accurate aim are needed to hit only the gangsters in the lineup.

Reaction time and shooting skill are again tested in a street scene.



Players must shoot the tin cans and keep them in the air to earn points.

Shoot To Win With VS. DUCK HUNT

If one sure hit isn't enough, Nintendo offers another bull's eye profit-maker—VS. DUCK HUNT.

This fast-action target game takes you into the marshes with your trusted hunting dog at your side. He'll flush the ducks out from hiding. Then, it's up to you to bring them down and shoot your way to an exciting bonus round.

Flushed out from hiding, the ducks become targets for the player's gun.

After two successful hits, the hunting dog retrieves the fallen birds.

On the practice range, players take aim at a succession of clay pigeons.

Light gun attachment required at additional cost.

Make The Mark With The VS. SYSTEM

VS. HOGAN'S ALLEY and VS. DUCK HUNT are part of Nintendo's VS. SYSTEM of interchangeable games—the most flexible and inexpensive game conversion system on the market today.

You can buy either game in a dedicated version for the new single monitor VS. UNISYSTEM.™ Or, mix or match them for use with the dual monitor VS. DUALSYSTEM.™ As always, both new game releases are available as VS. PAKS™ for your current VS. SYSTEM hardware.

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UPRIGHT/VS. UNISYSTEM (Single Monitor) Dimensions: 23¾"(W)×32⅜"(D)×68⅜"(H) Weight: 250 lb.

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CONVERTED UPRIGHT/VS. UNISYSTEM [VS. UNISYSTEM KIT available for Donkey Kong,™ Donkey Kong Jr.,™ Popeye,* Mario Bros.™ (narrow cabinet only) and Donkey Kong 3™ cabinets.]

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VS. HOGAN'S ALLEY and VS. DUCK HUNT, two great games for the VS. SYSTEM—Games that never stop earning.

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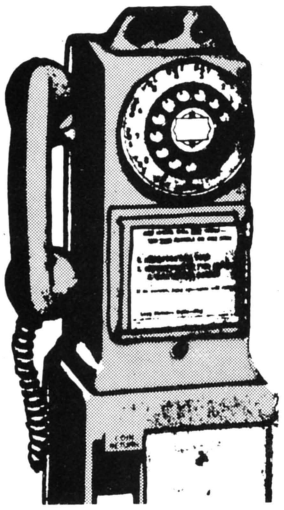
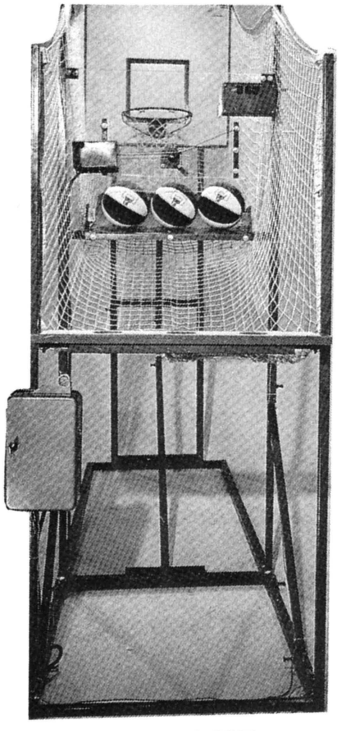


PHONECO

Pay Phone
Private coin-operated pay phone.



POP-A-SHOT

Pop-A-Shot
Basketball throwing novelty piece.

RAND OF PHOENIX

RSV-1000
Private coin-operated pay phone.

Rand Telephone
Coin-operated private pay phone.

ROTH NOVELTY

Diga Mart
By Sega. A skill digger crane for merchandise.

ROTHSCHILD

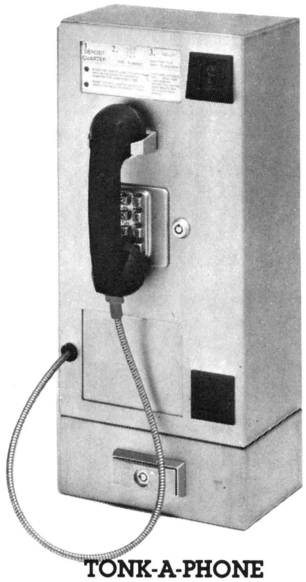
Suncenter 2000
Computer generated suntanning system.

TECH VEND

BP 5000
Coin-operated or free use heart rate/blood pressure computer.

TELECREATIONS

2410
Private coin-operated pay phone.



TONK-A-PHONE

203 C
Private coin-operated pay phone.

VENDING ALTERNATIVES

Coin-Laser Press Mega 3 Diffuser
Prints message on customer's penny.

WEIGHMASTER

Weighmaster
Hi-tech coin-operated video scale that analyzes weight gain or loss in calories.

WILLIAMS

Strike Zone
New look and new sounds on this shuffle alley.

XCP

VendaPhone
Private coin-operated pay phone.

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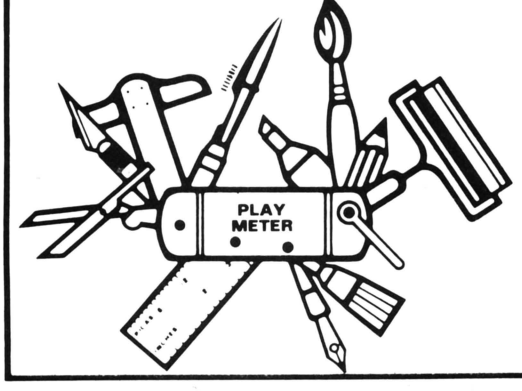

PLAY METER
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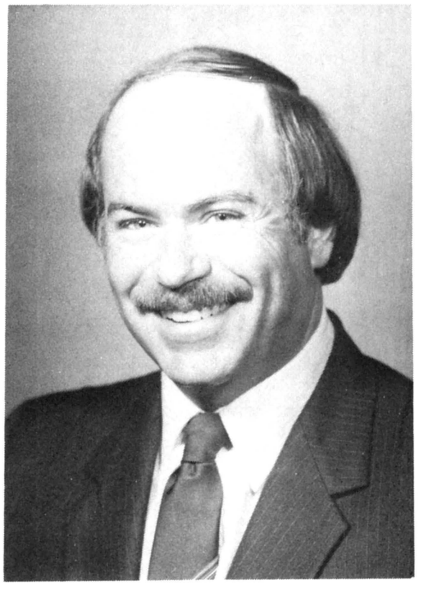
504/488-7003

COIN-OP'S CREATIVE CRISIS:

A three-part interview with Steve Kirk

Part III



"I designed a game I'd want to play so you'd want to play it."
—Mark Cerny, designer/programmer
MARBLE MADNESS
NEW FROM ATARI COIN GAMES.

A current Atari advertisement pictures Mark Cerny, designer and programmer of Atari's Marble Madness, *standing behind two gigantic marbles and saying, "I designed a game I'd want to play so you'd want to play it." This type of industry recognition for the individual creator is a very new trend in the coin-op amusement industry. It stands in marked contrast to the previous posture of most major game manufacturers.*

Before this, designers were not singled out for their creative contributions to the industry. New games were introduced as mere by-products from corporate entities, rather than as creations from individual designers. This is very different from other entertainment industries which give recognition to their creators.

By suggesting in the past that new games come solely from faceless entities in corporate research and development departments, major game manufacturers implied that game creation was more technological than imaginative and more corporate than individual. And so the focus within this industry turned from innovative new game concepts to the aggregate dollars spent on R&D (i.e. Bally spends X dollars on R&D, Williams spends Y dollars, and Atari Z dollars).

That's why corporate advertisements with individual game designers being given credit is certainly a new twist. In this final installment of the three-part interview with Steve Kirk on the creative coin-op crisis, we examine why this individual recognition to game creators is so important to new game creations and the industry as a whole. Besides helping the operator, Kirk insists, it can also spur creativity.

A designer of a number of pinball games who has authored a book on pinball, Kirk is familiar with the inner workings of the research and development departments of the Chicago manufacturers, having worked at one time or another in most of them. Kirk, who can be reached at P.O. Box 496, Park Ridge, Illinois 60068, is planning a game manufacturing venture in this industry which, he says, will reverse a lot of this industry's approaches to game creation.

PLAY METER: You say there's a need for advanced planning, for cohesiveness, as far as manufacturers intro-

ducing new equipment. But isn't it true individual game designers within each company work on competitive projects?

KIRK: With most manufacturers, yes, that's the case. And that's one of the problems with the design R&D aspect. Instead of working collectively for the finished product, what you have is a bunch of people working on separate ideas which may have no cohesiveness whatsoever. And this often affects the marketing and sale of products. For instance, you have a manufacturer who makes a terrific game, and people buy it. Then, when that manufacturer has another game coming out, operators, thinking that manufacturer is hot, will buy the next game up front. Only this time management has grabbed a game from another designer, and this game's not in the same league as the other game. It's nowhere near the same caliber of game. And the operator, who bought something on speculation because he thought it would be representative of the last product he bought from that company, is confused. He has no way of buying on speculation.

PLAY METER: In other creative industries—in book publishing and motion pictures, for instance—the creator has a certain degree of name recognition. But this isn't the case with our industry. From what you're saying, wouldn't it be simpler to let operators and players know who designed which games?

KIRK: You're falling into my briar patch there. Yes, there's no question about this. All designers are egotists, myself included, because part of what you're trying to accomplish is name recognition. You want to know that there are people out there who appreciate your work. But it goes beyond that. You'd like to know that they know who you are.

Actually, a designer tries to build his own signature into his games. In my case, for instance, I invented this little post between the flippers that appeared on all my games. And a writer in Philadelphia picked up on that and started calling it the "Kirk Post." And that was the idea. It was sort of my unwritten signature. When people saw that post, they were supposed to know it was one of Steve Kirk's games. Eventually, of course, the other manufacturers started using the Kirk Post on their games, and even that unwritten signature was lost. But it's something a designer strives for, recognition.

PLAY METER: So you would say that if this industry gave name recognition to the designers of its game, it might become a stimulus for them to create better games?

KIRK: Exactly. In 1978 I designed a pinball called *Stars* where I was able to do something about that. For many, many years I have felt that the game you design should have the potential of creating a following. My point is, if you like a certain music group, you will try and listen to all their songs. And when that group comes out with a new album, you don't even have to listen to all their songs before you decide on buying it. If you're a big enough fan of theirs, you'll just buy their records automatically because you know their style of music appeals to you.

That same kind of logic hit me with pinball. Why shouldn't that work for game designers? And I started to ask questions like "Why can't I put my name on the game?" And, let me tell you, that was one helluva argument I got into. I guess I sort of became the martyr for that because no one had ever done that before. No video or pinball had the game designer's name on it until I did it on *Stars*. And I had to fight long and hard just for that. And it wasn't a particularly pleasant battle.

PLAY METER: What was the resistance to that?

KIRK: Basically, the factories are worried that, if they allow a designer to put his name on his games and he

becomes a star, the designer will be out of control, both financially and otherwise. They would like to keep him under wraps so no one else can steal him and he can't request more money. Actually, the manufacturers will have a difficult time dealing with a star designer, if they're not compensating him fairly because, if a designer is good enough, he'll get offers from other places.

In any case, I got my name on the game. And to say it was controversial would be an enormous understatement. It really rocked the boat. Sometime later, after other designers started getting their names on their games, I had a conversation with one of the other factory

presidents, and the matter of putting the names on the games came up. And he told me he was still having a hard time dealing with that. You see, there's this great reluctance in the coin-op amusement industry to give credit where it's due. It seems the biggest desire is to control the people who work on the games and not let them become stars.

And I look at it the other way around. I'd want the people under me to be stars. I'd love to have a whole stableful of stars and for each of them to have his own identity. The only company I know which really went this route was ActiVision. They made the little home video games, but they realized early on the value of making their people stars. They would even have a picture of the designer and a little story about him, just like you would see on book covers. And that had the effect of helping future games by that same designer because people would say, "Hey! I like that guy's games. Let's check this one out!"

PLAY METER: How did the other designers react to your having your name on *Stars*?
KIRK: Actually, they thought it was just some big ego trip Steve Kirk was on. "Kirk's on such a big ego trip that he has to have his name on the game." But that wasn't it at all. It was strictly marketing. After all, a good design is good marketing. You're selling a product. And it doesn't matter if you have the greatest product in the world, if you can't sell it to people, the merits are meaningless.

But, really, do you think I could have sold Gary Stern on the wisdom of putting my name on *Stars* if it was just an ego trip? The only reason he allowed me to put it on was because he saw the logic of it when I showed it to him. It's simply a marketing idea. If that movie says Steven Spielberg on it or George Lucas, you're going to take a second look at it, and you'll go to see it because it says George Lucas or Steve Spielberg. And it might not be any better than another movie playing down the street, but you don't know anything about who made that other movie. And you know what kind of movies George Lucas and Steve Spielburg make, and you know it's something you're probably going to like. That's the whole idea behind establishing an identity for the designer.

PLAY METER: But what if the game isn't an individual effort? What if it is the conceptual product of several people?
KIRK: That would be a little more difficult, but it could be done, especially on a video game. It could be broken down as this guy did the graphics, this one the sound, this one the hardware, and so on, just like credits for a movie.

PLAY METER: But wouldn't that be the case in most instances.
KIRK: Not really. In my case, for instance, I do the board. I do the geometry. I do the rules, the concept. I even specify the artwork. The artwork on all my games was done to my specifications. I wasn't the artbrush, but I specifically authored the artwork to my specifictions and, in several instances, called for it to be redone. And the

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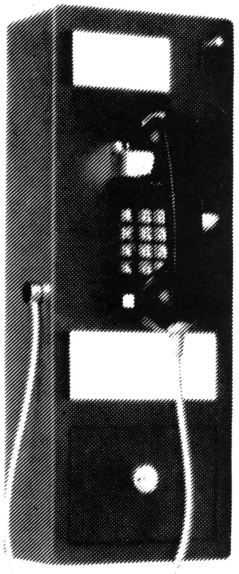

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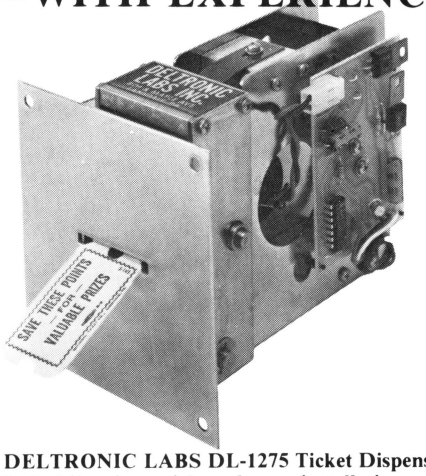

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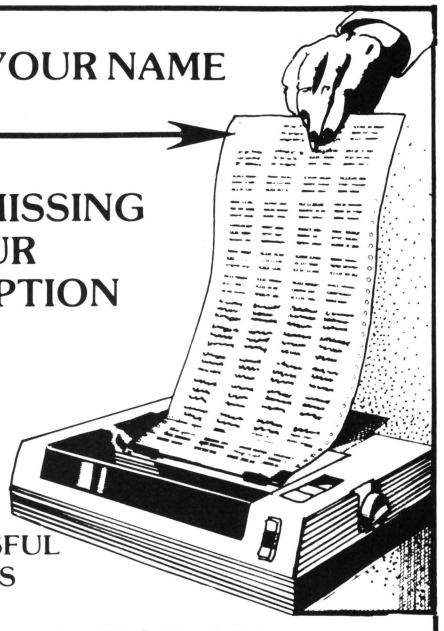

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reason for that is I also see the artwork as part of the marketing package as well as a representative of me as a designer.

PLAY METER: And that's what you sought to establish by having your name on *Stars*?

KIRK: The idea was to establish an identity on my games and have people look for certain characteristics in them. For example, if they learn that there are certain types of rules I use on one game and they see I've designed another game, some of the knowledge they gained from previous games by me might be applicable on this new game. And that gives the dedicated player an advantage and something to look forward to.

I plan on having in my "Next Evolution of Pinball" concept an identity to all my games that will tell people that these games are all part of a group. And that, since they are all part of a progression and parts of a group, the players will start to realize there are certain machines of the group they might not have played. And, hopefully, they'll seek them out. This is an aspect of marketing that's been non-existant in this industry until I did it. But it starts with getting your name on the game.

PLAY METER: The whole reason we investigated this area is to help the operator make more intelligent buying decisions, if he knows games by certain designers are more likely to be better games than games by other designers. Shouldn't this carry over to having the designer's name on the advertising information?

KIRK: This is the point where I lost out. That's where Gary Stern drew the line. He felt that was going too far because I was, in effect, an independent contractor and not locked into him. He was getting feedback from his distributors that they wanted another game from this guy Kirk, and he did send out information on a separate piece of paper that the game was designed by me. But it wasn't advertised to the trade as a whole.

The problem with the advertising brochures right now is I'm not sure they're really effective in selling the games anyway. The average operator is not a player; so to have a brochure that tells you that if you go through the Whiz Bango loop, you score 32,000 points, isn't a particularly relevant part of the operator's decision-making process when it comes to deciding whether to buy that piece of equipment.

But, if the operator knew who designed the game, he could probably tell if the game is geared for average or below average or above average players. This is how name identification of game designers could help operators. If an operator can identify the kinds of players a prospective game might appeal to—average or above average—he would be in a better position to make a decision as to whether that game would be good for him. And if he did buy it, he would know what locations would be best suited for the game.

To me, this all speaks well for the manufacturer to do this because it's another way he can show the operator how he can make more money out of his games. And, of course, if the operator can make more money out of a manufacturer's games, the operator is going to be happier

If players know certain games are part of a group, they'll seek them out.

with his purchases from that manufacturer and more likely to buy more from him.

But, if I sell you a game, and you don't know how to use it, or what kinds of players it's most likely to appeal to, or how to set it up; and the game fails because the operator didn't understand the inherent qualities of the game, then the game is ruined. And the operator is left with a sour taste about that manufacturer's future product.

PLAY METER: Now we're getting into the area of how an operator can affect a game's impact on the marketplace. Do you have any thoughts in this area?
KIRK: Plenty. There's an ignorance on the part of operators as far as what to do with a game after they get it. They don't know how to run it.

PLAY METER: Can you be more specific?
KIRK: Let me give you an example of an arcade here in the Chicago area. The operator has an *Eight-Ball Deluxe* pinball in there. And, if the player flipped the game hard, if he put any effort into the flip, the game would tilt. And I was in there when this player kept tilting because of this. And he really got irked and hit the game a couple of times because of it. And when he did, the operator came over and wanted to throw him out. He told the player you can't hit the game like that. And the player complained that the game tilted if you just flip the flipper. And the operator told the player not to flip it so hard. And they ended up getting into an argument because the player said that shaking is part of the game, that it's inherent in the play of the game. But the operator responded, "Not here it isn't." And that's a hard attitude for a player to deal with. And I'm telling you, as a designer, the player is right. Shaking is part of the game.

Many operators are ignorant as to how to run the pinballs. They abuse the tilt mechanisms. They'll use them as play inhibitors. But the tilt mechanisms was put in there not as a play inhibitor but as an anti-cheat device. Pinball has more integrity than any game out there, but it's got a very major problem, particularly with the new style operator. Here's a guy who got used to taking a video game off the truck and plugging it in, and that was it. Nothing could be simpler. Anyone can do that. But that's not true with pinball. The old-style operator was a guy who had judgement, who knew the difference between a flipper that had power and a flipper that was weak. He understood what the game was supposed to do and that it had a certain feel to it. He knew there was a judgemental factor in how the game was set up. And he was willing to invest a certain amount of preventative maintenance and knew how to fix things that broke.

But the operator of the '80s doesn't know this stuff. Many of them have no idea how to set up a game. They don't know the difference between a spinner that rotates six times and a spinner that rotates 50 times. And when something breaks, he doesn't know how to fix it. And there are only two ways to solve that problem. One is to educate those operators, and the second is to make the games less likely to break down and need so much maintenance.

And I think both goals can be realized, but it's going to cost a few bucks. Now, this is something I've been fighting since back in the 1960s, but I contend you can make that game virtually indestructible for $100 a game. And I think the operator will pay an extra $100 per game or, hell, let's make some profit from it, and charge $150 for making the game indestructible and ridding the operator of all the aggravation he's having right now.

PLAY METER: Is this getting back to manufacturers wanting to build in mechanical obsolescence in the games?
KIRK: Yes, the trend is still to make a game as cheap and dirty as possible, and I just don't understand the logic of that. This whole country is built around premium products. We have premium quality cars, premium quality stereos, premium quality everything, even premium quality ice cream. But there are no premium quality games. And why not?

The player has the right to expect certain performance standards that aren't being delivered. For instance, there's absolutely no reason why 95 percent of the breakdowns occur on a pinball machine except for a

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lack of effort on the part of the manufacturer to make it better. We're still using 1950s technology. We could make that game indestructible. But, like I said, the top management in manufacturers' circles are afraid that if they make games that don't fall apart they won't sell anymore games. We're dealing with pinballs that work, mechanically, roughly equivalent to those in the '50s. The games are falling apart.

PLAY METER: Getting back to the operators' influence on the marketplace, do you see any other things which operators did which cut short the game's life?

KIRK: One thing in particular, tokens. Now I was one of the first people in the industry to use tokens. I was using them in the mid-1970s, but what I'm talking about was what happened during the video game boom when tokens started to proliferate. I now believe tokens played a definite role in killing the video game business, at least the arcade business.

It doesn't matter if it's food or sex or video games, whenever you can have all you want of it, the appeal diminishes. And tokens opened the way for that to happen in the arcade business. When, for competitive reasons, arcades started selling tokens for more than four for a dollar—and there were cases of people selling 12 for a dollar—they were cutting their own throat. The obvious mistake the operators were making when they did that was they were reducing their income per play, but at least as important was that they were allowing players more plays per buck. And, as a result, the player's burnout rate on a particular game occurs faster because they're getting more plays per dollar.

You see, too many operators thought it was better to fill up their arcades than to have them only half-occupied. They thought it was better, psychologically, to have lots of players standing in front of the games. But they were wrong. That wasn't in their best interest. People were playing on the games for hours, playing to the point that they got sick of it and didn't want to play anymore. After playing at a discounted price for a long time, players didn't have the desire to come back. Instead, they felt they had too much of it for awhile.

What should have been the operator's aim was to make the players want to come back for more, where they always wanted to come back for more. But, with all this discounting of tokens, it got to the point where the players burned out on the games.

There are motivational aspects to the players wanting to play the games. You have to maintain a certain amount of denial of access to the game. It's the pursuit of that game and the inability to conquer it that keeps the player coming back for more. If you need an example, just look at what happened with everyone who's got an Atari video game system at home. They may have played the heck out of it for a couple of weeks, but I don't think you'll have too much trouble finding people whose home video games are just sitting there gathering dust. And the reason for that is they just got sick of it. They don't even want to hook it up anymore. And the reason for that is because they have the ability to play it all they

(continued on page 72)

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THE TRUE COST OF A BANK LOAN

By Bryan E. Millings

A business pays a visible interest charge when it borrows from a bank. But that is seldom the only cost the business pays for the credit consideration. Less obvious factors can significantly increase the cost of borrowing from a bank. A business owner should recognize these costs before seeking a bank loan.

One cost develops from the compensating balance a bank typically requires as a stated or implied part of a loan agreement. Thus, in order to obtain bank credit consideration, a business owner usually must agree to maintain a checking account balance equal to 20 percent to 30 percent of the loan. The compensating balance provides the bank with additional funds for lending elsewhere.

Unfortunately, the requirement for a compensating balance forces a business to borrow more than it actually needs. For example, a business that needs to borrow $20,000 may find it necessary to borrow $25,000 to satisfy the bank's requirement for a 20 percent compensating balance. The firm pays for $5,000 in credit consideration that must sit idle in its checking account.

A business owner can measure the cost of a compensating balance by relating the actual dollar cost of a bank loan to the borrowed funds actually employed. Thus, assume a bank charges a 16 percent annual interest rate for the $25,000 loan noted above. Since the business gains the use of only $20,000 out of that amount, the compensating balance requirement raises the firm's real borrowing cost as follows:

1. Annual borrowing cost @ 16%	=		$4,000
2. Interest rate based on funds actually used	=	$\frac{\$\ 4,000}{\$20,000}$	= 20%

Thus, the compensating balance requirement makes the firm's real borrowing cost four percent higher than the apparent interest rate. That difference represents a 25 percent increase over the visible charge. The chart provides a view of the impact various compensating balance requirements have on a firm's real borrowing cost across a range of interest rates.

		Compensating Balance Requirements		
		10%	20%	30%
Apparent interest rate	10%	11.1%	12.5%	14.3%
	15%	16.7%	18.8%	21.4%
	20%	22.2%	25.0%	28.6%

Real interest rates

A look at the chart indicates that a compensating balance requirement boosts a firm's real borrowing cost more as the apparent interest rates rise. But in any circumstances, the need for a compensating balance increases the real cost a business incurs when it borrows from a bank.

That cost can increase further when a bank imposes restrictive covenants as conditional elements in a loan arrangement. Common restrictive covenants may preclude a borrower from incurring additional debt, purchasing fixed assets, expanding operations, or even increasing the owner's salary. The bank also might expect the business to observe certain financial constraints. For example, a business might have to maintain current liabilities. Or the firm's total debt in any circumstance might be restricted to an amount equal to the business owner's equity.

From the banker's perspective, restrictive covenants encourage a borrower to avoid any action that might prevent eventual repayment of a loan. Indeed, anytime a borrower violates a restrictive covenant, the bank can demand immediate repayment of any credit consideration outstanding.

However, the borrower often finds that restrictive covenants represent another addition to the apparent cost of a bank loan. That cost develops when a covenant delays or precludes management action that can be profitable for a business. The firm may not incur a direct cost for that restriction. But it foregoes some profit. The effect on the bottom line is the same.

Legal fees are often another addition to the cost of bank credit consideration. The larger and more complex the lending arrangement, the more likely a business will incur such fees.

In some instances, legal fees arise when a cautious business owner employs an attorney to review a loan agreement before execution. In other circumstances, the bank passes the cost of preparing loan documents on to a borrower. In either case, the legal fees often translate into a substantial increase in the true cost of a bank loan.

Still another additional cost comes from the time a business owner has to spend negotiating renewals. Two common circumstances raise the need for such negotiations.

First, many bank loans call for a lump sum repayment at the end of a fixed term. For example, a bank might expect repayment—along with the interest charges—90 days or six

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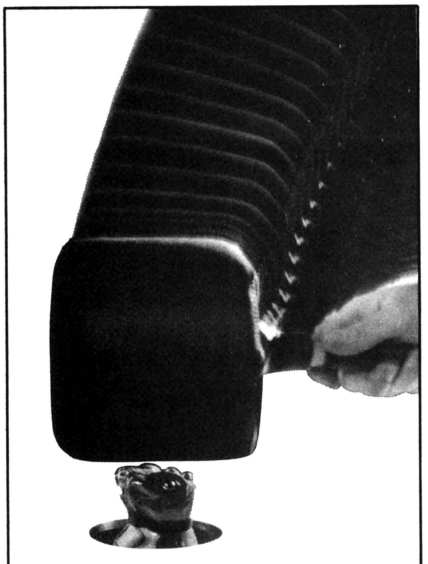

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months after funding a business loan. This represents a single payment bank loan.

However, many borrowers are unable to retire a single payment loan as originally agreed. Perhaps the original purpose that justified the loan remains unfulfilled. Or a changing business environment necessitates another use for the cash earmarked for the repayment.

If the borrower remains credit worthy, the failure to meet the original repayment schedule is seldom a cause for serious concern. But the bank still must approve any request to renew a loan for another term. Consequently, a business owner must spend valuable management time explaining the need for the loan renewal. This time can translate into a significant increase in the cost of bank credit consideration.

Of course, if negotiating a renewal requires no more than a phone call or a brief visit to the bank, the incremental cost remains small. However, the cost rises rapidly as the management time devoted to the negotiating process increases. After all, a business owner can't generate profits while locked in negotiations with a lender. The more valuable the business owner's time, the larger the incremental cost incurred from the need to negotiate a loan renewal.

Finally, the need to negotiate a loan renewal also imposes another hidden charge on a borrower—the cost of uncertainty. Inevitably, bank financing remains uncertain financing. Thus, a business owner can never rest completely assured that his bank will renew a maturing single payment loan.

In some circumstances, deterioration in the borrower's financial condition may create a demand for payment. But in other circumstances a bank may require repayment merely as proof that the borrower actually can operate without the loan. Periodic "clean-up" requirements remain a fetish affecting many bankers.

The uncertain response to any request for a loan renewal becomes another management obstacle for a borrower. While waiting for the bank's approval, a business owner often must delay important decisions that affect the firm's earnings. The business may incur unnecessary costs or miss opportunities for profits. Either circumstance creates one more addition to the cost of bank credit consideration. •

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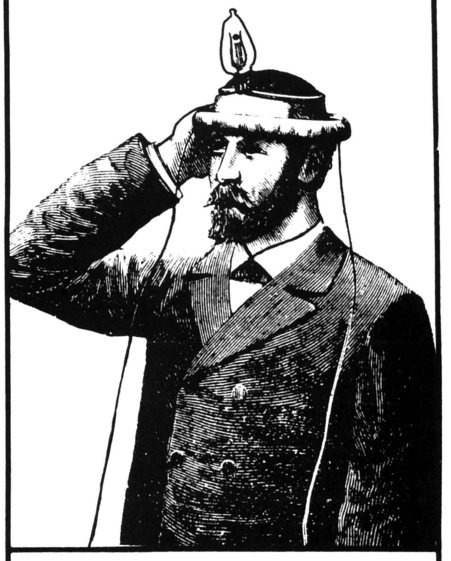

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MOS/FET-J/FET Circuit Design

Lesson 12: Switching Circuits

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Lesson Twelve – Switching Circuits. This lesson includes the use of MOSFETs and JFETs in digital circuits. Both static and dynamic characteristics are studied.

INTRODUCTION:

One of the well known and perhaps better uses of FETs is in the design of switching circuits. In this lesson, the term **switch** will refer to a device whose output is in either a low impedance, high conducting state or a high impedance, low conducting state. This is more commonly known as the **ON** or the **OFF** state, respectively.

Through many applications, it has been found that FET

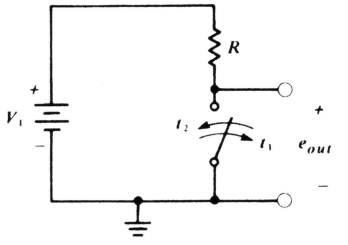

Fig. 12-1. Simple Switch Example.

switches offer several advantages over bipolar types. Among these are:

1. **High fan-out capability** – due to the high input impedance of the FET. This means that the output of one switch or **gate** is capable of driving the inputs of many others.

2. **Voltage controlled switching** – allowing the use of high valued resistors which reduces the power dissipation requirements.

3. **Low output impedance** – due to the low channel resistance in the **ON** state.

4. **Complementary configuration** – available with MOSFET circuits since both p and n-channel devices can be used together. This reduces the power dissipation to a very low level.

5. **Low temperature drift** – attributed to the low temperature coefficients of the material.

However, there are some disadvantages of FET switches which also must be mentioned. These are:

1. **Capacitance input** – caused by the junction capacitance which can increase the response times when high levels of resistance values are used.

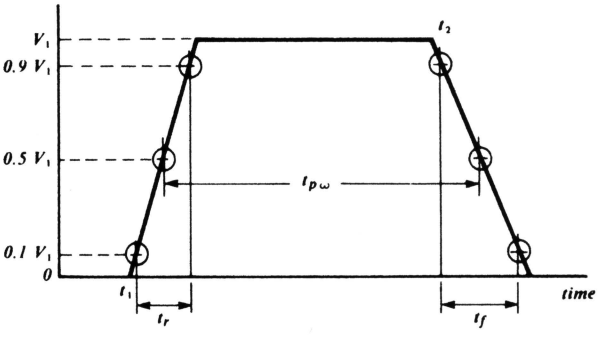

Fig. 12-2. Typical Switched Voltage Waveform.

2. **Dual supply voltages** – necessary in some JFET switching circuits.

3. **Careful selection of MOSFET threshold voltages** – necessary to insure that the device is full **ON** or full **OFF.**

The contents of this lesson will deal with the examination of FET switching characteristics by considering the basic switching theory of these devices and the variety of FET switch types. Applications of FETs in various switching circuits (i.e, gates, flip-flops, etc.) will give some insight to the many uses of FETs in this area.

SWITCHING THEORY:

To better understand the theory of FET switching circuits, it is desirable to know something about the type of voltage and current waveforms which will be studied. When a device is switched from one state to another and then back to the original state, a **pulse** is generated. Suppose, for example, that a normally closed switch is connected between a voltage source and a resistor as shown in Fig. 12-1. Then assume that the switch is

opened at time t_1, then closed again at time t_2. The voltage across the switch (e_{out}) will have the typical **wave shape** shown in Fig. 12-2.

DEFINITIONS:

From this figure, several useful terms can now be defined.

1. **Pulse Amplitude** – the difference between the final value after switching and the initial value before switching. For the waveshape in Fig. 12-2, the amplitude is V_1.

2. **Rise-Time** – labeled t_r, this is the time it takes for the voltage to rise from 10% of the amplitude to 90% of the amplitude on the leading edge of the pulse.

3. **Fall-Time** – labeled t_f, this is the time required for the voltage to go from 90% of the amplitude to 10% of the amplitude on the trailing edge of the pulse.

4. **Pulse Width** – labeled t_{pw}, this is the time measured between the 50% voltage amplitude points on the pulse.

There are other terms which tend to define pulses more closely; however, the ones given here should suffice in the discussion of FET switches. The definition of a perfect switch is a device that has zero voltage drop across its terminals when closed and allows zero current through its terminals when open. This definition will be useful when comparing FET switch types.

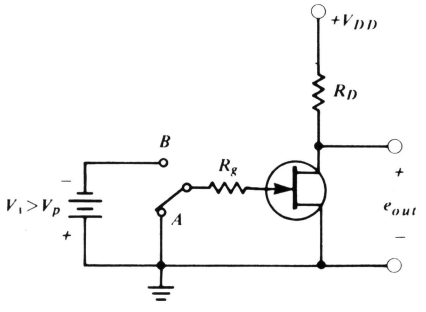

Fig. 12-3. Simple JFET Switch Circuit.

STATIC CHARACTERISTICS:

The basic FET switch, unlike the linear amplifier, operates at either of the extreme ends of the drain load line. In Fig. 12-3, a typical JFET switch is shown which is similar to the simple switch in Fig. 12-2. This type of switch is sometimes called an **inverter** since the output inverts the D.C. logic level appearing at the input. The drain circuit load line for the circuit is shown in Fig. 12-4 indicating the **ON** and **OFF** points. For the device to be fully **ON** (switch in position A), the operating point lies on the zero V_{GS} curve which has a slope of $1/r_{ds}(on)$.

The value of $I_D(on)$ at this point is given by

$$I_D(on) = \frac{V_{DD}}{R_D + r_{ds}(on)} \qquad (12\text{-}1)$$

which is usually less than I_{DSS} to insure the minimum drain-source resistance. The output voltage, e_{out}, is given by

$$e_{out} = V_{DS}(on) = r_{ds}(on) \cdot I_D(on) \qquad (12\text{-}2)$$

$$e_{out} = \frac{r_{ds}(on)\, V_{DD}}{R_D + r_{ds}(on)}$$

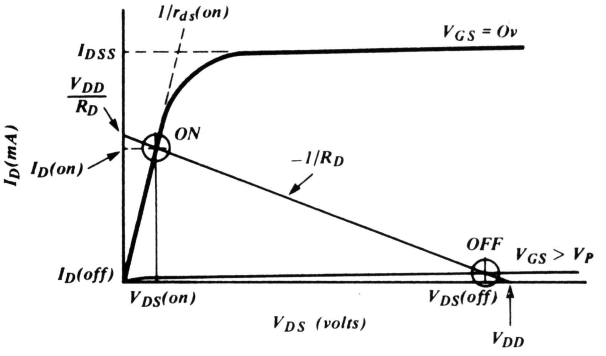

Fig. 12-4. JFET Switch Drain Circuit Load Line.

A typical JFET will have a low value of $r_{ds}(on)$ allowing $V_{DS}(on)$ to be small and therefore approaching one of the basic requirements of a perfect switch. The characteristics of the 2N5163 show that $r_{ds}(on) = 125\Omega$ for an I_{DSS} of 14mA. By designing for an $I_D(on)$ of 5mA, the value of $V_{DS}(on)$ will be

$$V_{DS}(on) = I_D(on) \cdot r_{ds}(on) = 5mA \cdot 125\ \Omega$$

$$V_{DS}(on) = 0.625\ v$$

By placing the switch in position B, the gate-source voltage is V_1 which is assumed to be greater than V_p, the pinch-off voltage. For this gate voltage, the device will be **OFF** and the drain current will decrease to $I_D(off)$. For the perfect switch, this **OFF** current must be zero. However, due to the channel leakage current, $I_D(off)$ will be some finite value usually in the nanoamp range for JFETs. For most applications, this much leakage current can be tolerated.

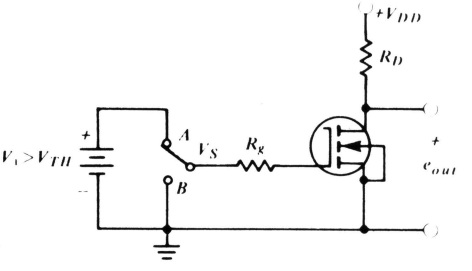

Fig. 12-5. Simple MOSFET Switch.

Because of their construction, enhancement mode MOSFETs make nearly perfect switches. Fig. 12-5 shows a MOSFET switch in the same inverter configuration as the JFET in Fig. 12-3. By placing a positive voltage on the gate (which is greater than V_{TH}), the device will be **ON** and the drain-source resistance will be $r_{ds}(on)$. The amount of drain current can be determined by Eq. 12-1 as was done for the JFET. If the switch is placed in position B, the MOSFET will be **OFF** and the drain current will be $I_D(off)$. The value of $I_D(off)$ for a MOSFET device will be much lower than that of a JFET, usually in the picoamp range. Similar to the JFET, this current is leakage current that flows across the reverse-biased region in the drain. As an example, the 2N4268, which is a p-channel enhancement mode MOSFET, has

a typical I_D (off) of 200 pA and a typical r_{ds}(on) of 75 Ω, both of which allow the device to approximate a perfect switch.

The information gained from these two simple FET circuits show that there are two parameters which characterize their performance as switches.

1. r_{ds}(on) – The **ON** channel resistance, which must be low for a good switch. This allows the voltage across the drain-source terminals to approach zero when the device is **ON.**

2. I_D(off) – the **OFF** drain current, must also be low to insure near zero current flow through the device when it is **OFF.**

These two terms can aid the designer in choosing one particular device over another when requirements about the static **ON** and **OFF** states are known.

DYNAMIC CHARACTERISTICS:

The dynamic switching characteristics of FETs involves its rise and fall-times as the circuit responds to an input pulse. A FET's response time is dependent upon its gate junction capacitance and the equivalent gate and drain resistances. It has been shown that for an RC network, the rise or fall-time is approximately equal to

$$t_{r,f} \cong 2.2\,\tau \qquad (12\text{-}3)$$

where τ is the time constant of the RC network. This approximation will be accepted throughout the context of this section.

Consider the initially **ON** equivalent circuit of the JFET inverter shown in Fig. 12-6. With the switch in position A, the drain resistance is r_{ds}(on) and the output voltage is V_{DS}(on) where

$$V_{DS}(on) = \frac{r_{ds}(on)}{R_D + r_{ds}(on)}\, V_{DD} \qquad (12\text{-}4)$$

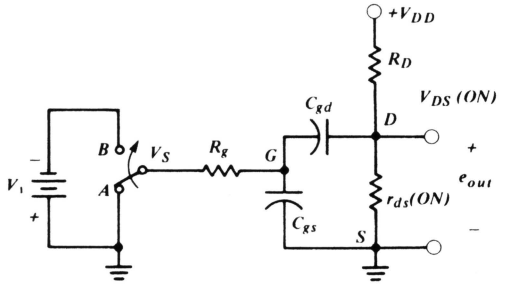

Fig. 12-6. Equivalent Circuit of a JFET Inverter.

The voltage across C_{gd} is V_{DS}(on) and across C_{gs} the voltage is zero. By throwing the switch to position B, the voltage across C_{gs} starts to charge to $-V_1$. Since this capacitor voltage is the same as the gate-source voltage, the device will begin to turn **OFF.** However, before the output voltage can rise to $+V_{DD}$, C_{gd} must charge to $V_{DD} + V_1$ with the time-constant

$$\tau_1 = C_{gd}\left[R_g + \frac{R_D\, r_{ds}}{R_D + r_{ds}}\right] \qquad (12\text{-}5)$$

which is also the charging time constant of the output voltage. The value of r_{ds} will start to increase from r_{ds}(on) to some large value based on the time constant of the gate-source voltage which is

$$\tau_2 = C_{gs}\, R_g \qquad (12\text{-}6)$$

Therefore, it can be seen that the output rise-time which is

$$t_r = 2.2\, C_{gd}\left[R_g + \frac{R_D\, r_{ds}}{R_D + r_{ds}}\right] \qquad (12\text{-}7)$$

will be a nonlinear function of r_{ds} and τ_2. However, some approximations can be made if it is assumed that C_{gs} is much larger than C_{gd} initially. This will allow r_{ds} to remain r_{ds}(on)

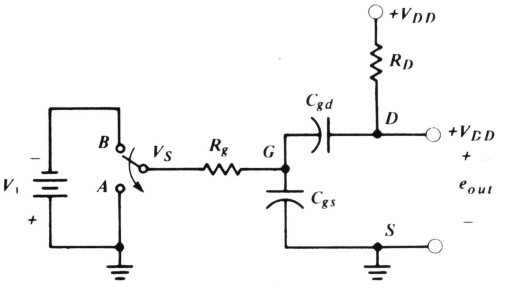

Fig. 12-7. Equivalent OFF Circuit of the JFET Inverter.

long enough for C_{gd} to charge up faster than C_{gs}. In which case, the rise-time will be approximately

$$t_r \cong 2.2\, C_{gd}\,[R_g + r_{ds}\,(on)] \qquad (12\text{-}8)$$

since $R_D \gg r_{ds}$ (on).

The output fall-time can be found by considering the JFET to be initially **OFF** with the switch in position B as shown in Fig. 12-7. The drain will essentially be an open circuit which makes the output voltage approximately equal to $+V_{DD}$. This will produce a voltage of $V_{DD} + V_1$ across C_{gd} and $-V_1$ across C_{gs}. As the switch is placed in position A, C_{gs} will discharge through R_g allowing V_{GS} to approach zero volts with the time constant in Eq. 12-6. Just after the switch is thrown to position A, C_{gd} will start to discharge through R_g and R_D. However, as the JFET is turned **ON** by the discharging of the gate circuit, the drain-source resistance begins to approach r_{ds}(on) in which case C_{gd} starts to discharge through the parallel combination of R_D

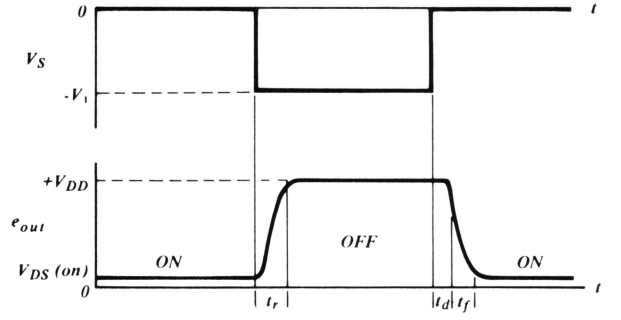

Fig. 12-8. Input and Output Voltage Waveforms for the JFET Inverter.

and r_{ds}. As was the case for the rise-time, r_{ds} will be a function of the gate circuit time constant which makes the fall-time also a nonlinear function.

In general, it can be assumed that there will be a short delay time before the device begins to turn ON. This delay time is approximately

$$t_d = 2.2\, C_{gs}\, R_g \qquad (12\text{-}9)$$

which is necessary to allow the gate-source voltage to reach zero volts and the device to be fully ON. After this delay, the output voltage will fall to $V_{DS}(on)$ with the time

$$t_f = 2.2\, C_{gd}\, [R_g + r_{ds}\,(on)] \qquad (12\text{-}10)$$

which is the same as the rise-time.

Since the MOSFET has nearly the same equivalent circuit as the JFET, except for the input voltage polarity, then the expressions for the rise and fall-times are approximately identical to those in Eqs. 12-8 and 12-10. It must be remembered, though, that the MOSFET turns ON with a positive voltage and turns OFF with a zero or negative voltage.

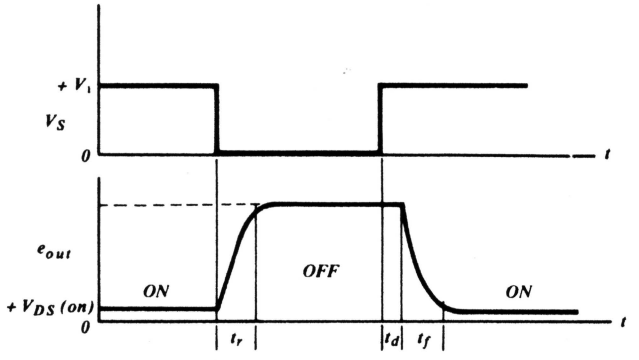

Fig. 12-9. Input and Output Voltage Waveforms for the MOSFET Inverter.

Fig. 12-8 shows typical input and output waveforms for the JFET inverter and Fig. 12-9 shows the same for the MOSFET circuit. The switch movements are assumed to have zero rise and fall-times. Notice that for each set of waveforms the output pulse has an inverted polarity to that of the input.

EXAMPLE 1:

A typical JFET inverter is shown in Fig. 12-10. Compute the rise, fall, and delay times given the device parameters below

$r_{ds}(on)$ @ I_D = 0mA = 100 Ω

C_{gs} @ 1.0 MHz = 15pF

C_{gd} @ 1.0 MHz = 10pF

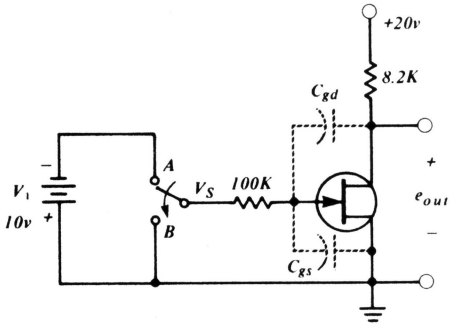

Fig. 12-10. Example of a JFET Inverter.

The rise and fall-times are given in Eqs. 12-8 and 12-10 as

$$t_{r,f} = 2.2\, C_{gd}\, [R_g + r_{ds}(on)]$$

$$t_{r,f} = 2.2 \cdot 10 \cdot 10^{-12} \cdot [100 \cdot 10^3 + 100] \text{ sec}$$

$$t_{r,f} = 2.2\ \mu\text{sec}$$

The delay time is given by Eq. 12-9 as

$$t_d = 2.2\, C_{gs}\, R_g$$

$$t_d = 2.2 \cdot 15 \cdot 10^{-12} \cdot 100 \cdot 10^3 \text{ sec}$$

$$t_d = 3.3\ \mu\text{sec}$$

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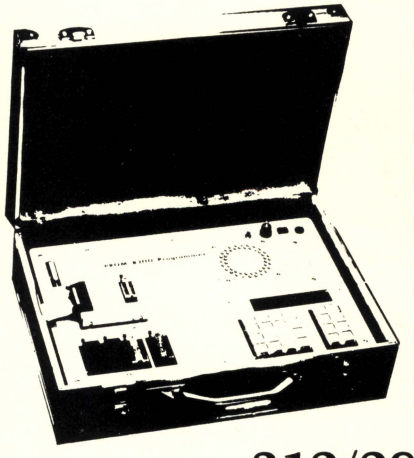

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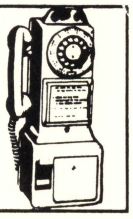

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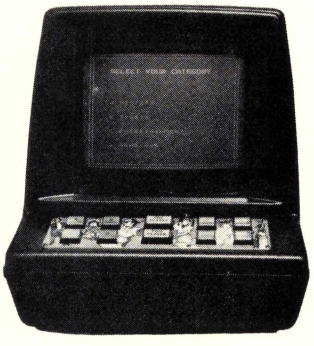

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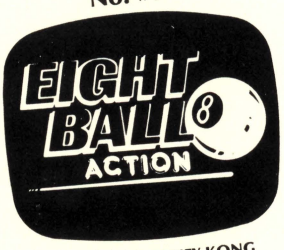

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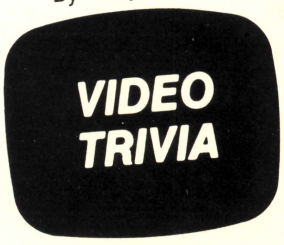

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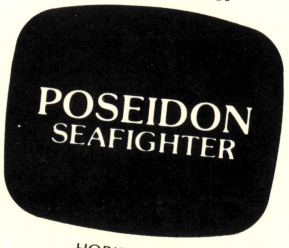

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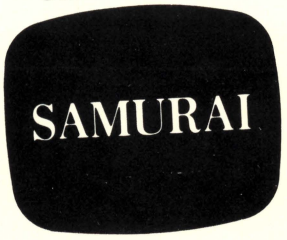

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Preguntar Por Cecilia

(continued from page 56)

When operators started discounting tokens, they allowed players to burn out on the games quicker.

want, whenever they want. There is no denial, and that's a big part of marketing.

PLAY METER: Recently we've heard comments from certain members of the manufacturing establishment where they have pronounced in the mass media that the coin-operated amusement industry will never again achieve its past greatness. From a design point of view, would you agree with that?

KIRK: That's a helluva poor attitude, a self-serving attitude by manufacturing administrators. It's an alibi so they don't have to explain their own inability to produce good games. You can alibi anything by saying the business is over, and that way you don't look so bad. Or you can do something about it.

You want my opinion. I'll tell you. The potential for games is greater, much greater than we had even during the video game boom, but it's going to have to come from creative people. It's not going to come from administrators. The coin-op amusement industry is no longer going to be an administrative business. Manufacturers have to be controlled by creative people; and, when they are, you're going to see the next boom in games. The types of games may be entirely different. For instance, in the video game business—and I've presented this proposition over a period of five or six years but still haven't met anyone who believed strongly enough in it to put up money on it—in the video game business, you're going to see the video game by remote location.

PLAY METER: Could you explain that?

KIRK: We're getting back to the social aspect of games again, of people playing against people, rather than against machines. Let's say, for instance, we set up a video game on a network where you go in and buy time at a terminal. And that terminal connects in with other terminals, be they across town, across the state, or across the nation. But the games are all tied in. And you can jump into the game as one of many people. So, instead of buying, say, three ships for a quarter, you're buying time on the machine. And you become a participant in this battle in the game, whether it's a war in outer space or what have you. You buy the right to be on the screen with all those other people. And this is a whole different aspect because you have to learn the personalities and tendencies of the individual players involved in this game. And maybe you have to combine with other forces that are on your side and become part of a team. And you can work collectively to beat a common enemy.

That's a whole different aspect of games which I think has a tremendous future, but the cost of setting it up is enormous. But I see the day when you'll be able to sit down and rent time at the terminal and be tied in on a massive network that could have literally hundreds of players involved. And still it could have the integrity and a lot of fun for the individual player. In fact, such a game, with protentially hundreds of other players, may have more appeal because it generates a mass hysteria.

Something to realize is the next generation of games will emphasize the decision making process, not just with physical dexterity, but with strategy and intelligence. That's where it's at, with video games, at least.

Actually, what's missing from a lot of these games right now is they don't have that good time feeling. They're just a test of manual dexterity. And we've got to remember what we're selling is entertainment, not a test. Also, all the games that are out there are trying to satisfy an existing audience. I want to create games that not only satisfy the existing audience but also bring in new players. Instead of bringing in new players like *Pac-Man* did, we merely went from the old game to the new game and didn't bring in any new people. Only a few games ever achieved that. *Pac-Man, Dragon's Lair*, but the problem was everybody else just copied what they were doing, and they burned it out, instead of coming up with something different.

PLAY METER: And what about pinballs?

KIRK: That's my "Next Evolution in Pinball." Pinball has a tremendous future for a number of reasons that may not seem so obvious. One, you're not likely to have a home version of the game; so you're not likely to burn out on your home Atari pinball game. There's a social structure to the game. People can rotate in and out with a four-player game, for example. It's not as intense as a video game which demands all your attention. It's more like a pool game or darts in that respect. It can be played more casually. You can even walk away from it for a few mintues and come back to it, and that's important for pinball's future. •

The next generation of games will emphasize strategy and intelligence.

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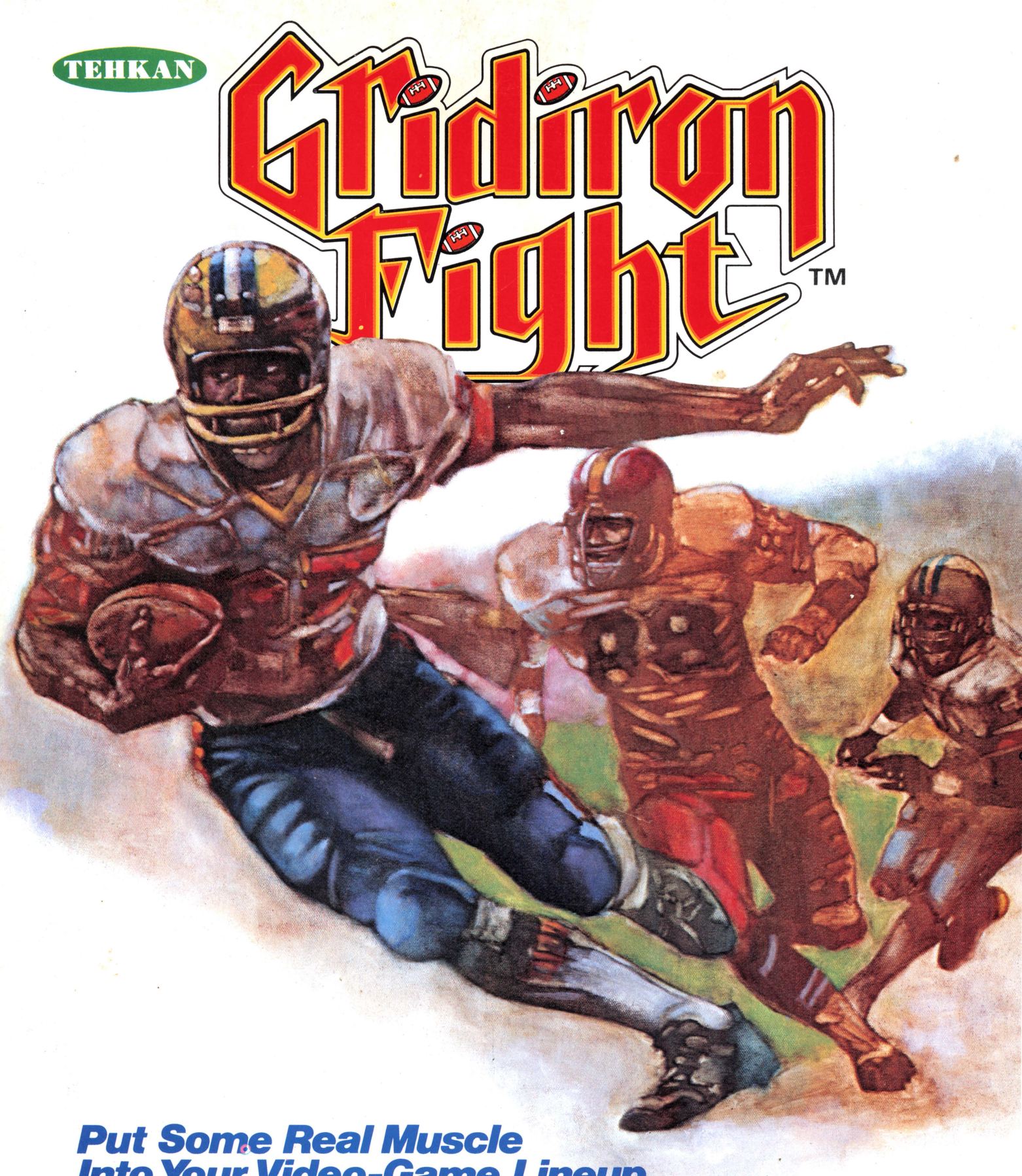

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